



COMPUTER
IMAGE
CORPORATION

WAVEFORM
FUNCTION GENERATOR

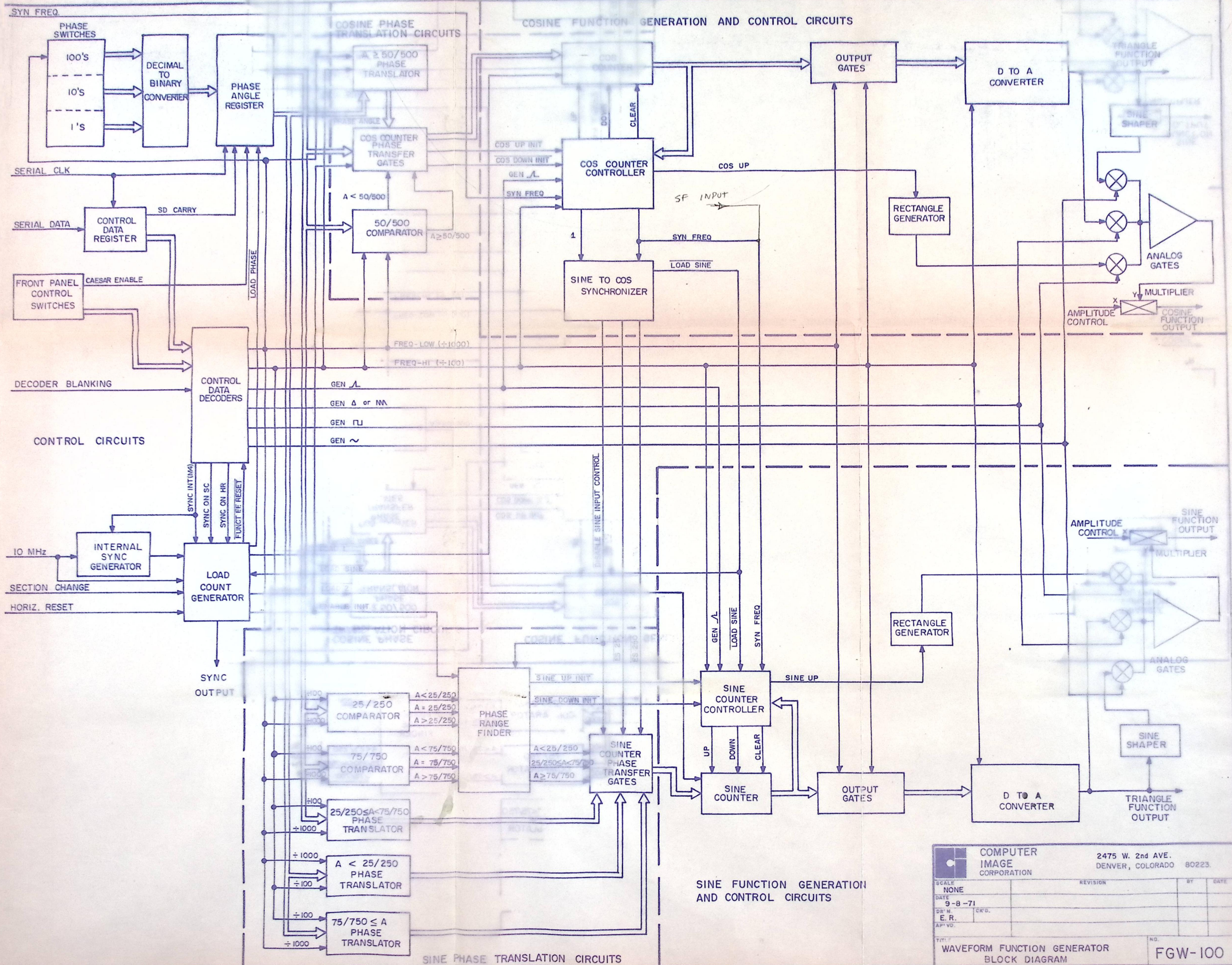
W. ALTEMUS

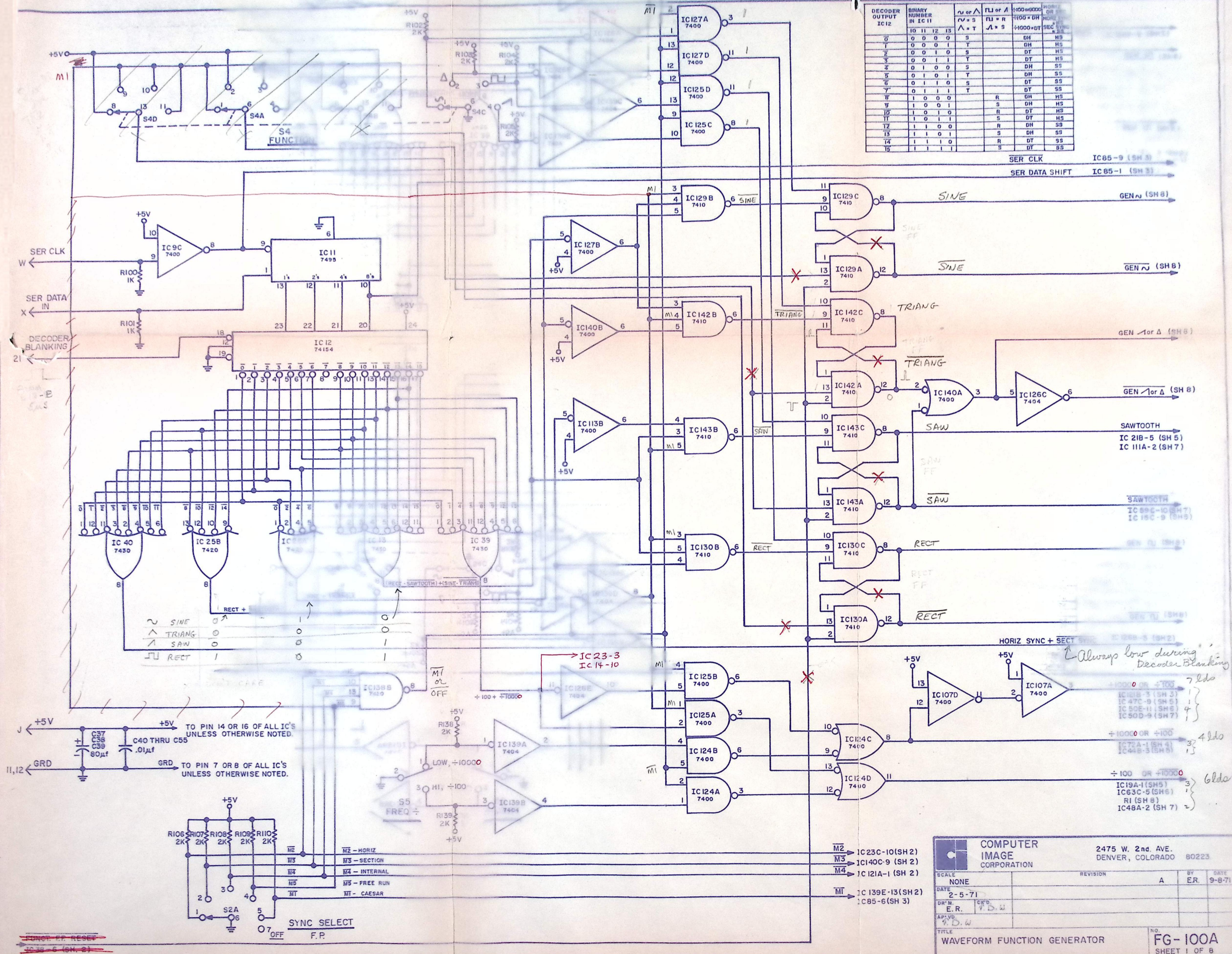


COMPUTER
IMAGE
CORPORATION

WAVEFORM
FUNCTION GENERATOR

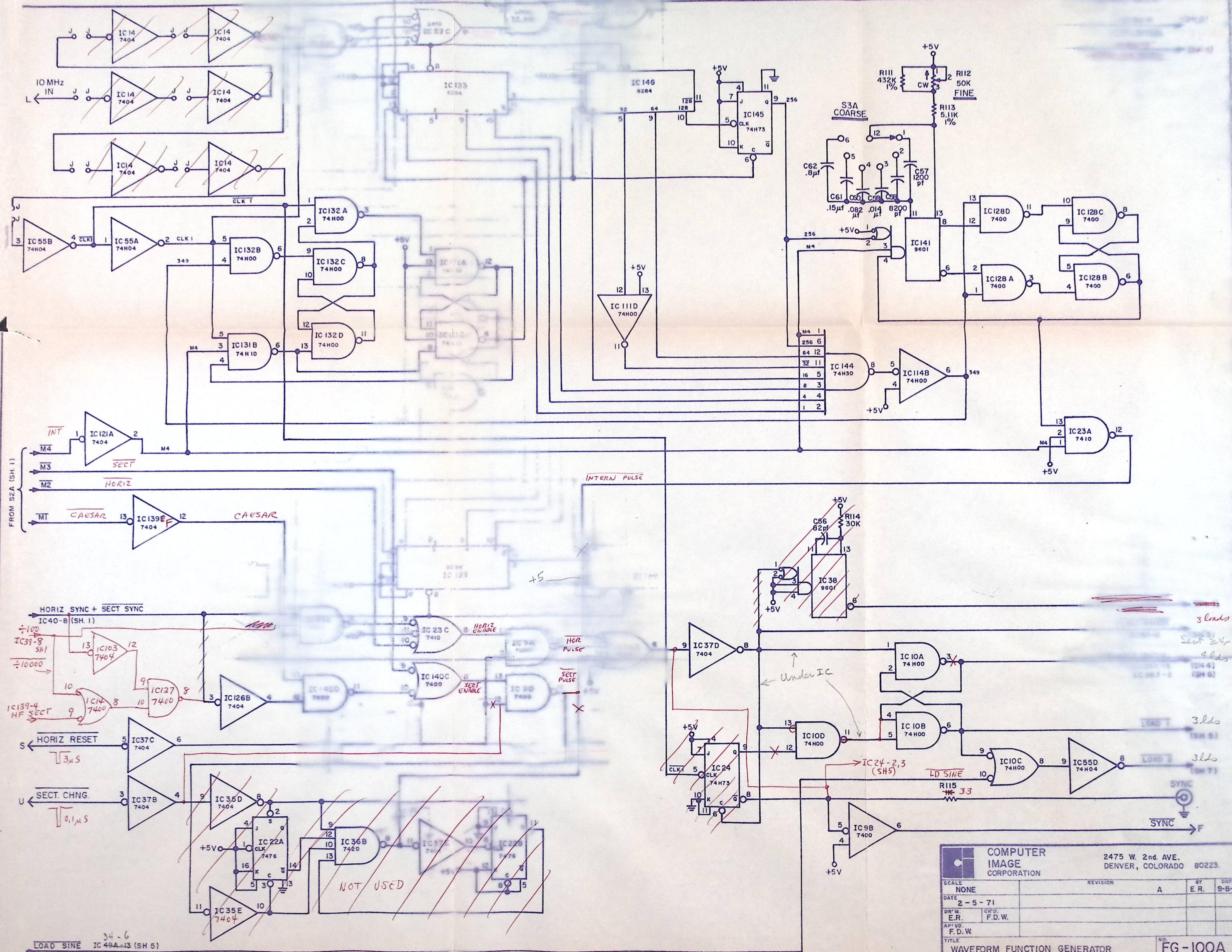
W. ALTEMUS

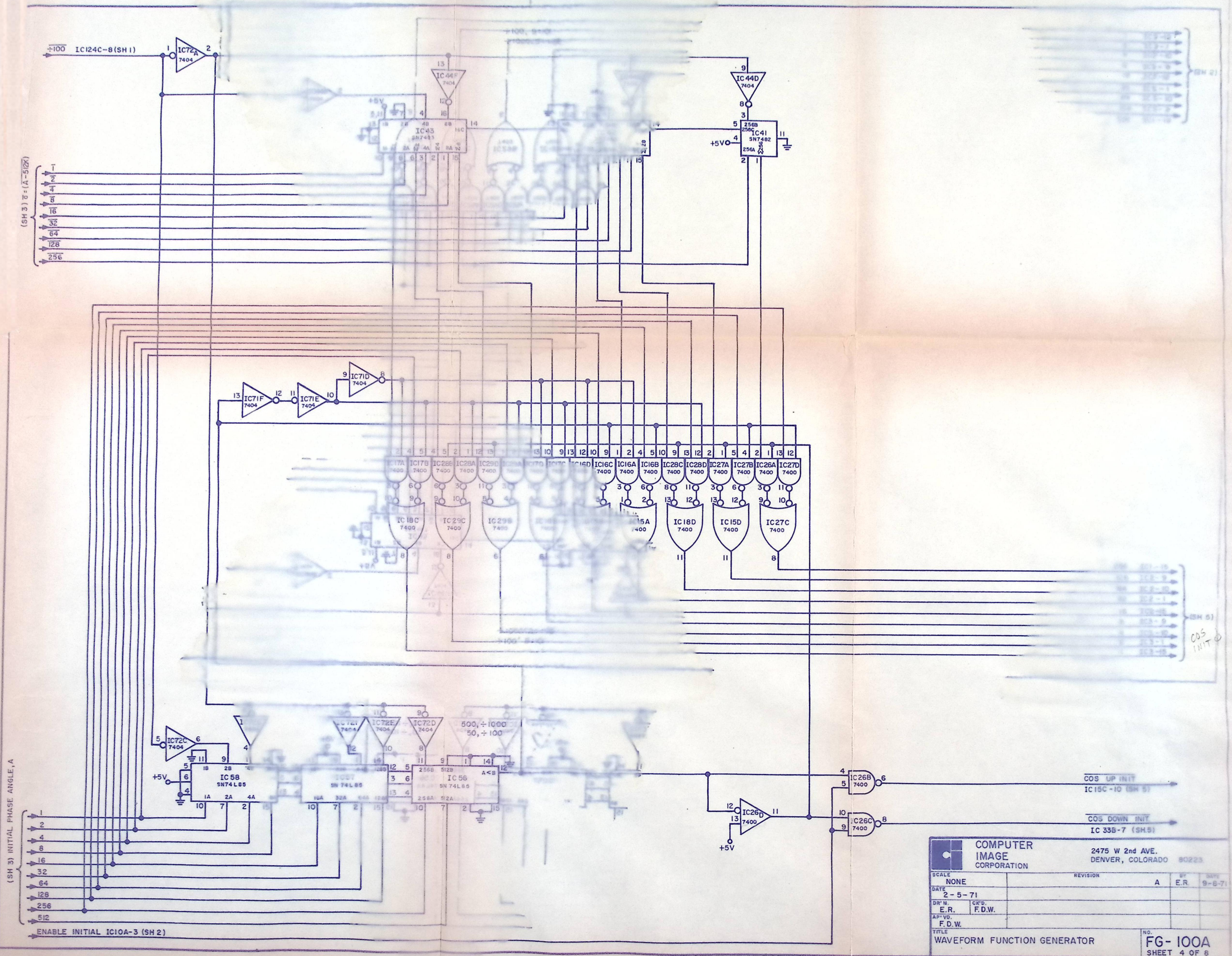


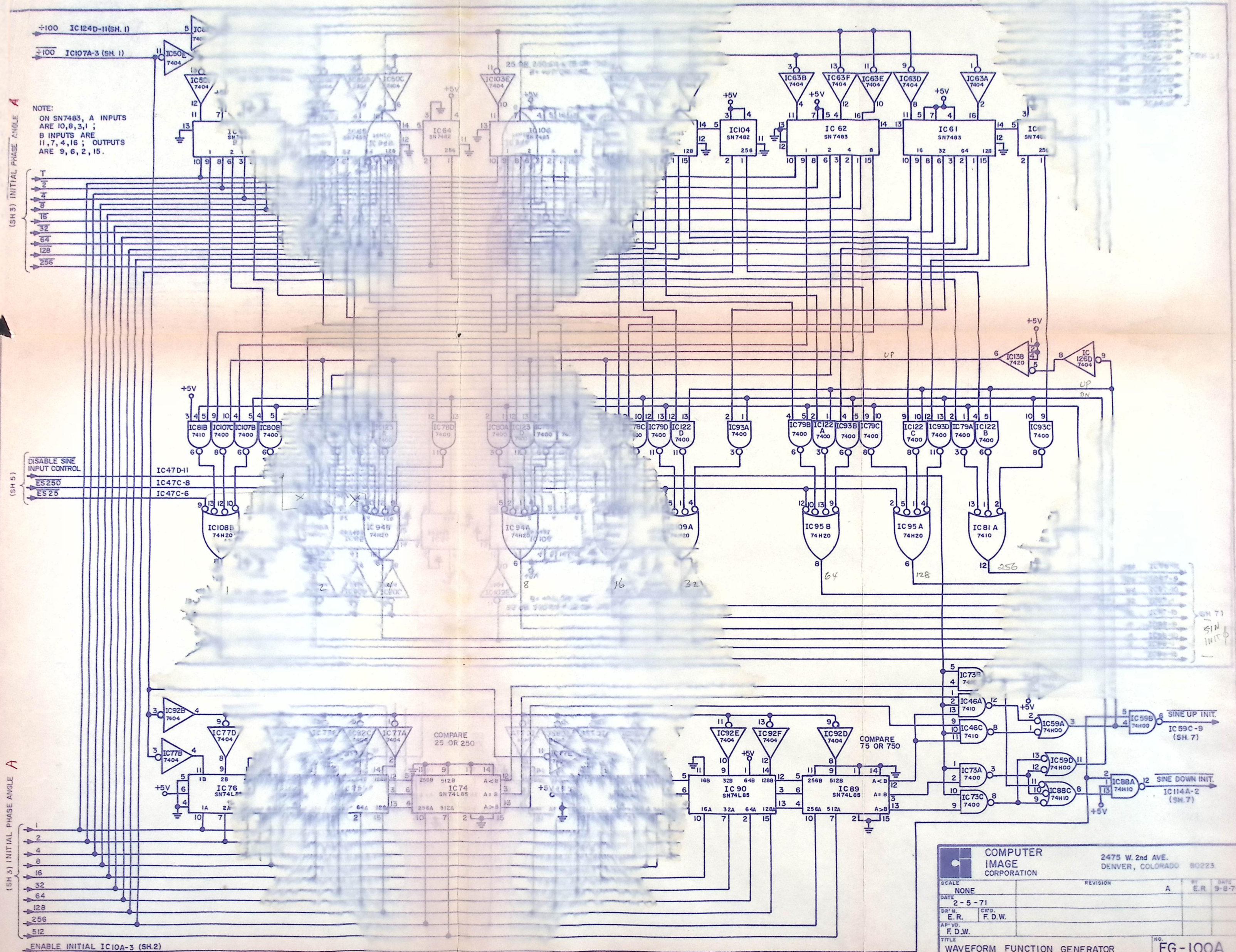


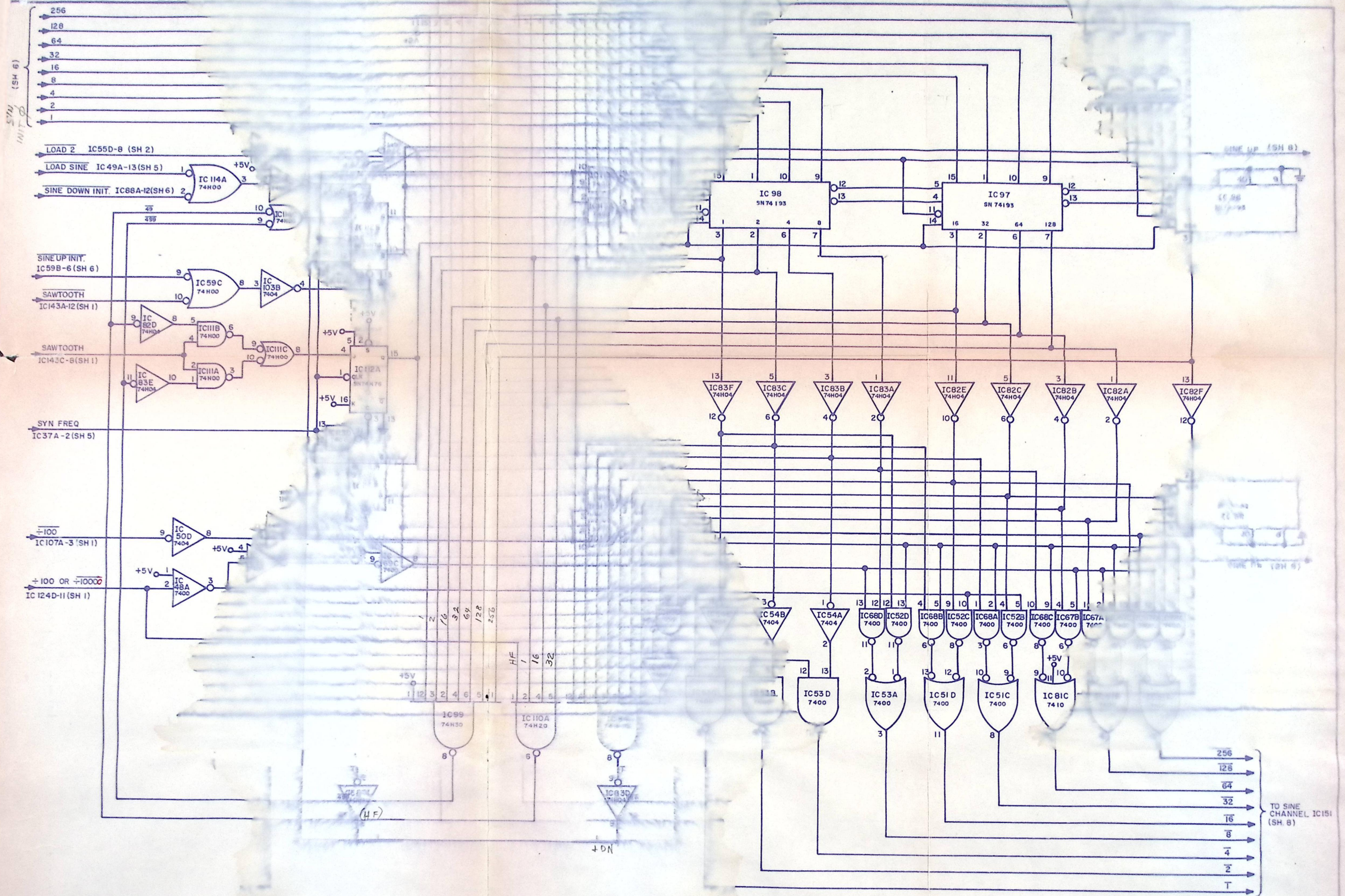
DECODER OUTPUT IC12	BINARY NUMBER IN IC12	$\sim$ or $\wedge$ $\sim$ = S $\wedge$ = T	$\vee$ or $\vee$ $\vee$ = R $\vee$ = S	$\sim$ or $\wedge$ $\sim$ = S $\wedge$ = T	$\vee$ or $\vee$ $\vee$ = R $\vee$ = S	HORIZ OR SECT
0	0 0 0 0	S				DH
1	0 0 0 1	T				DH
2	0 0 1 0	S				DT
3	0 0 1 1	T				DT
4	0 1 0 0	S				DH
5	0 1 0 1	T				DH
6	0 1 1 0	S				DT
7	0 1 1 1	T				DT
8	1 0 0 0		R			DH
9	1 0 0 1		S			DH
10	1 0 1 0		R			DT
11	1 0 1 1		S			DT
12	1 1 0 0		R			DH
13	1 1 0 1		S			DH
14	1 1 1 0		R			DT
15	1 1 1 1		S			DT

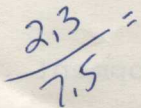
COMPUTER IMAGE CORPORATION		2475 W. 2nd. AVE. DENVER, COLORADO 80223	
SCALE NONE	REVISION A	BY E.R.	DATE 9-8-71
DATE 2-5-71			
DR. N. E.R.			
AP. V. P.D.W.			
TITLE WAVEFORM FUNCTION GENERATOR		NO. FG-100A SHEET 1 OF 8	











3,26

4.11

4.51

87

2, 7, 5

 5.83^3



UNIVERSITY OF DENVER

An Independent University

University Park, Denver, Colorado 80208

Center for Management Development
Office of the Director

For Engineers
An excellent opportunity to
enhance your professional development.

Dear Manager:

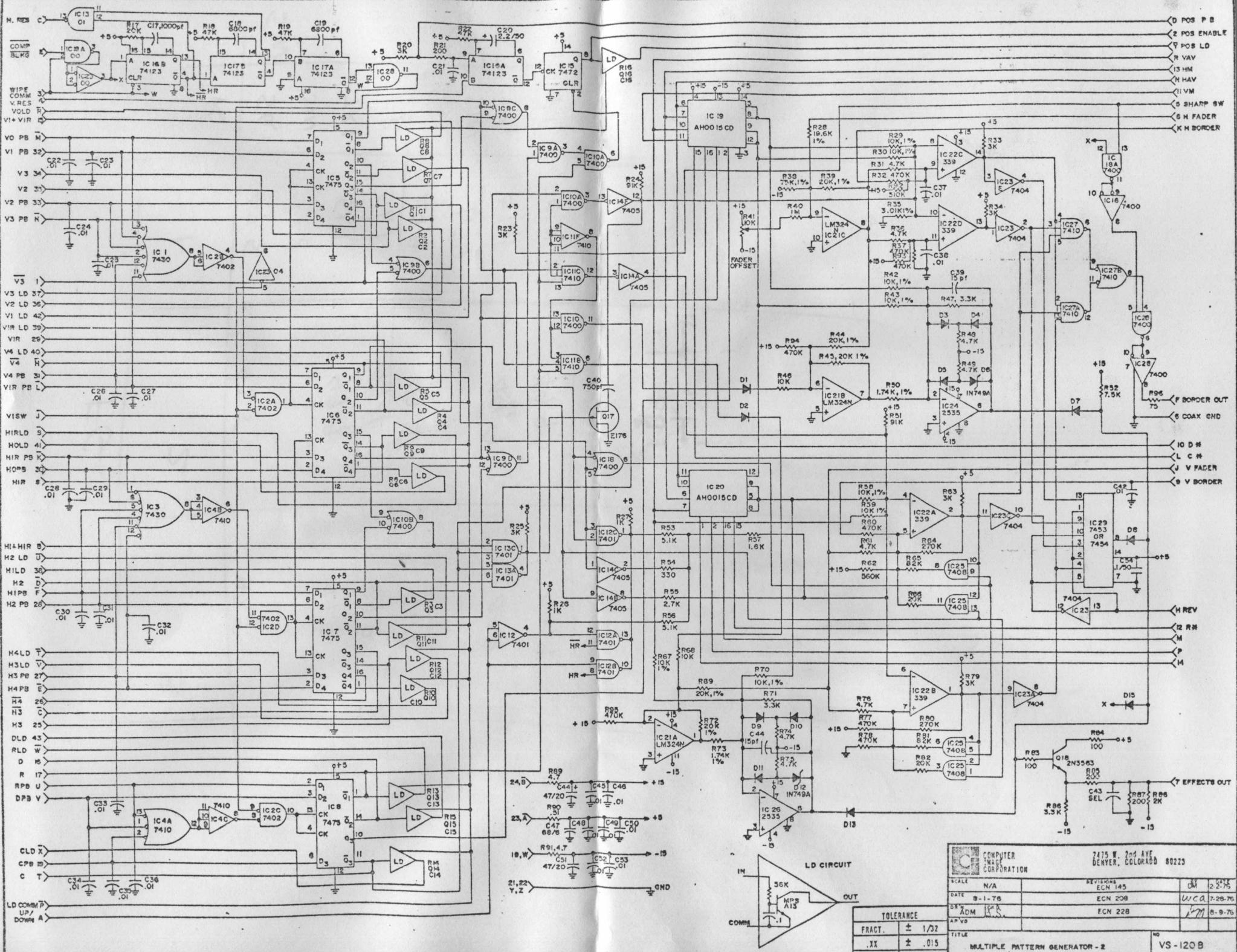
The University of Denver is pleased to present an important seminar that shows you how to maximize engineering performance:

THE ENGINEER AS MANAGER
March 14-15, 1985 in Denver, CO

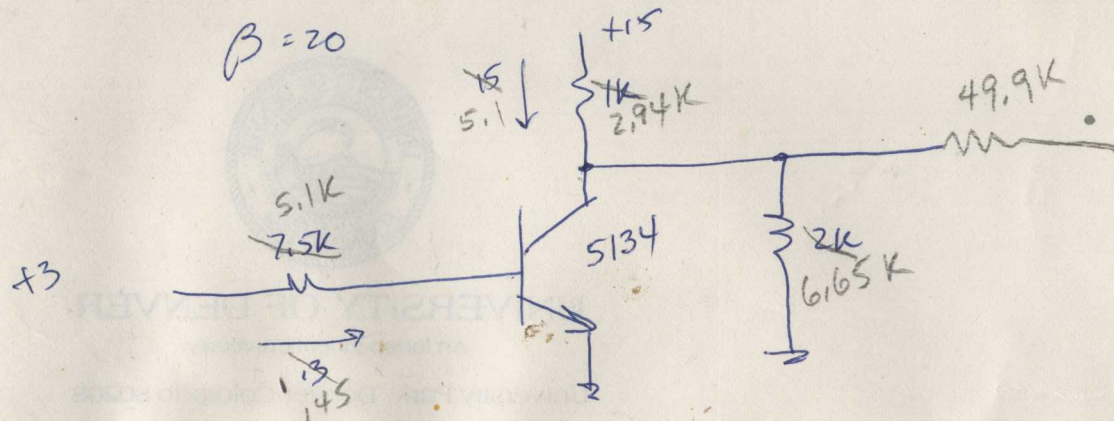
The speaker for this course will be Edward Luftig, a nationally recognized authority on engineering management. Mr. Luftig, who is president of his own consulting firm, has advised and conducted programs for over

FG

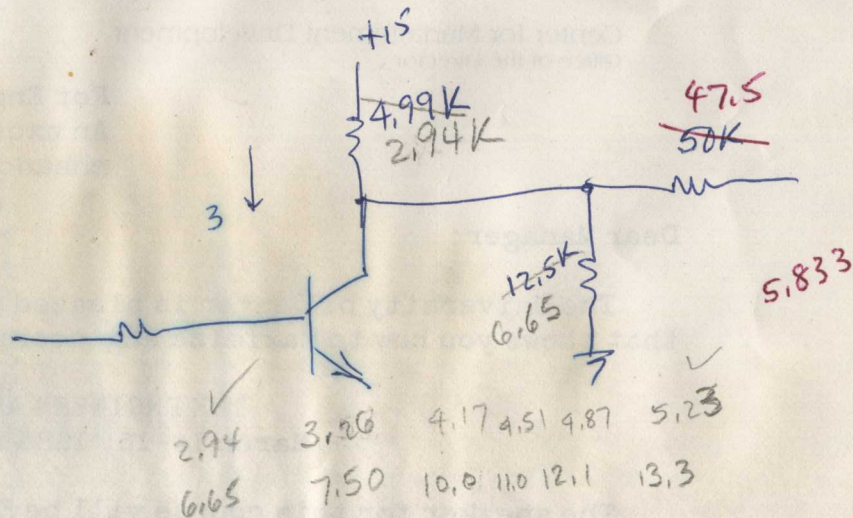
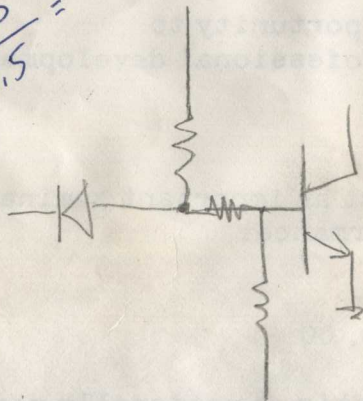
		1	2	3
SIN	R			
	SQ	47.5	47.5	47.5
	SIN	1.58		
	TRI	51.1	49.9	49.9
	FB	51.1	49.9	49.9
COS				
	SQ	49.9	47.5	47.5
	SIN	1.74		
	TRI	51.1	49.9	49.9
	FB	51.1	49.9	49.9

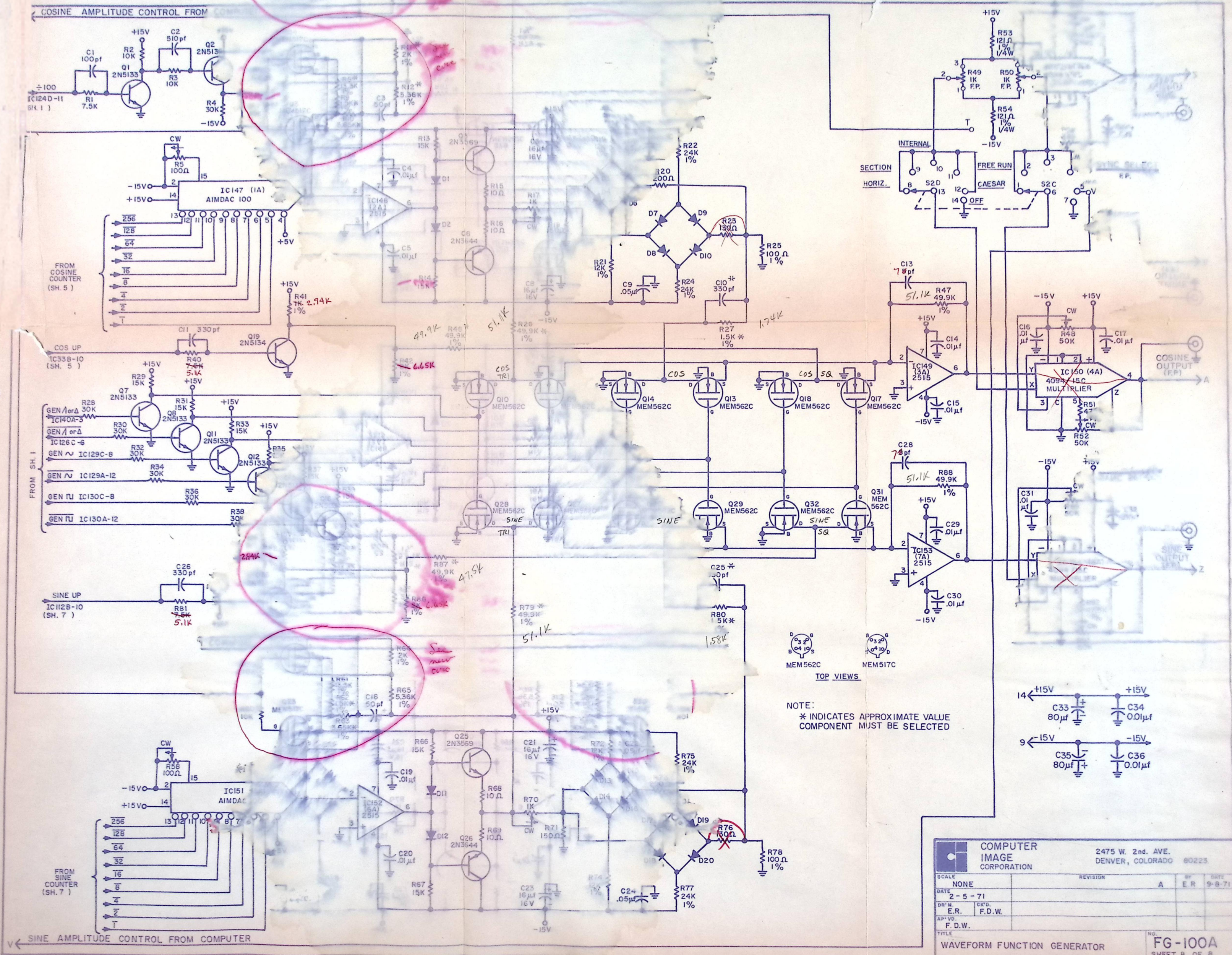


COMPUTER 1414 CORPORATION		2475 W. 2nd AVE DENVER, COLORADO 80223	
SCALE	N/A	REVISED	ECN 145
DATE	8-1-76	ECN 208	WCA 7-28-76
DRN	ADM 15A	ECN 228	LM 8-9-76
AP VS			
TOLERANCE		TITLE	
FRAC.	± 1/32	MULTIPLE PATTERN GENERATOR - 2	
.XX	± .015	VS-120B	
---	± .005		



$$\frac{2.3}{7.5} =$$





NOTE:
* INDICATES APPROXIMATE VALUE
COMPONENT MUST BE SELECTED

COMPUTER IMAGE CORPORATION		2475 W. 2nd. AVE. DENVER, COLORADO 80223	
SCALE	NONE	REVISION	A
DATE	2-5-71	BY	ER
DR'N	E.R.	CR'D	F.D.W.
AP'VD	F.D.W.		
TITLE		NO.	
WAVEFORM FUNCTION GENERATOR		FG-100A	
		SHEET 8 OF 8	

NO.		TYPE	NO.	
101	101	SN 74193N	1026	N 7400 A
102	102	SN 74193N	1027	N 7400 A
103	103	SN 74193N	1028	N 7400 A
104	104	SN 74404N	1029	N 7400 A
105	105	SN 74404	1030	N 7400 A
106	106	N 7400 A	1031	N 7400 A
107	107	SN 74420N	1032	N 7400 A
108	108	SN 74430N	1033	SN 74436N
109	109	N 7400 A	1034	SN 74410N
110	110	SN 74400	1035	N 7404 A
111	111	SN 74495N	1036	SN 74420N
112	112	SN 74154N	1037	N 7404 A
113	113	SN 7430N	1038	9601 M
114	114	N 7404 A	1039	SN 7430N
115	115	N 7400 A	1040	SN 7430N
116	116	N 7400 A	1041	SN 7482N
117	117	N 7400 A	1042	SN 7483N
118	118	N 7400 A	1043	SN 7483N
119	119	N 7404 A	1044	N 7404 A
120	120	N 7400 A	1045	SN 74430N
121	121	SN 74400N	1046	N 7410 A
122	122	SN 7476N	1047	N 7400 A
123	123	N 7410 A	1048	N 7400 A
124	124	SN 74473N	1049	SN 74473N
125	125	SN 7420N	1050	N 7404 A

NO. TYPE

1051 ~~PN~~ 7400 A

1052 ~~PN~~ 7400 A

1053 ~~PN~~ 7400 A

1054 N 7404 A

1055 SN 74404 N

1056 SN 74285 N

1057 SN 74285 N

1058 SN 74285 N

1059 ~~SN~~ 74400 N

1060 SN 7482 N

1061 SN 7483 N

1062 SN 7483 N

1063 N 7404 A

1064 SN 7482 N

1065 SN 7483 N

1066 SN 7483 N

1067 ~~PN~~ 7406 A

1068 ~~PN~~ 7400 A

1069 ~~PN~~ 7400 A

1070 N 7404 A

1071 N 7404 A

1072 N 7404 A

1073 ~~PN~~ 7400 A

1074 SN 74285 N

1075 SN 74285 N

1076 SN 74285 N

1077 N 7404 A

1078 ~~PN~~ 7400 A

1079 ~~N~~ 7400 A

1080 ~~PN~~ 7400 A

1081 N 7410 A

1082 SN 74404 N

1083 SN 74404 N

1084 SN 74430 N

1085 SN 7495 N

1086 SN 7495 N

1087 SN 7495 N

1088 ~~SN~~ 74400 N

1089 SN 74285 N

1090 SN 74285 N

1091 SN 74285 N

1092 N 7404 A

1093 ~~PN~~ 7400 A

1094 SN 74420 N

1095 SN 74420 N

1096 SN 74193 N

1097 SN 74193 N

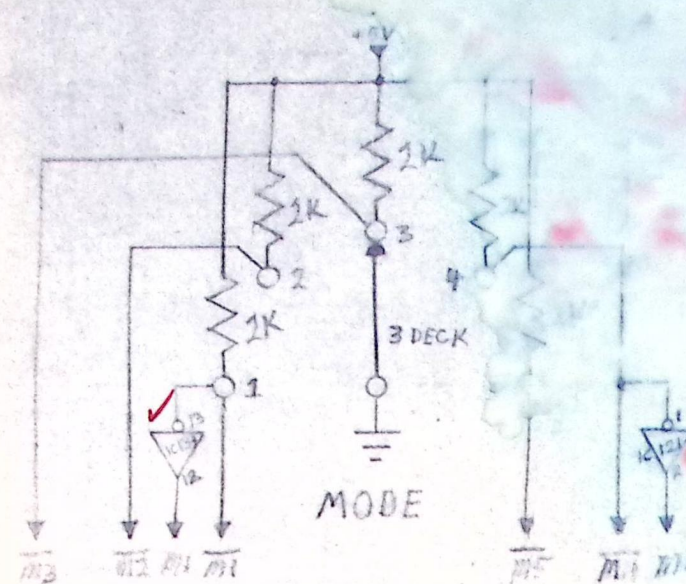
1098 SN 74193 N

1099 SN 74430 N

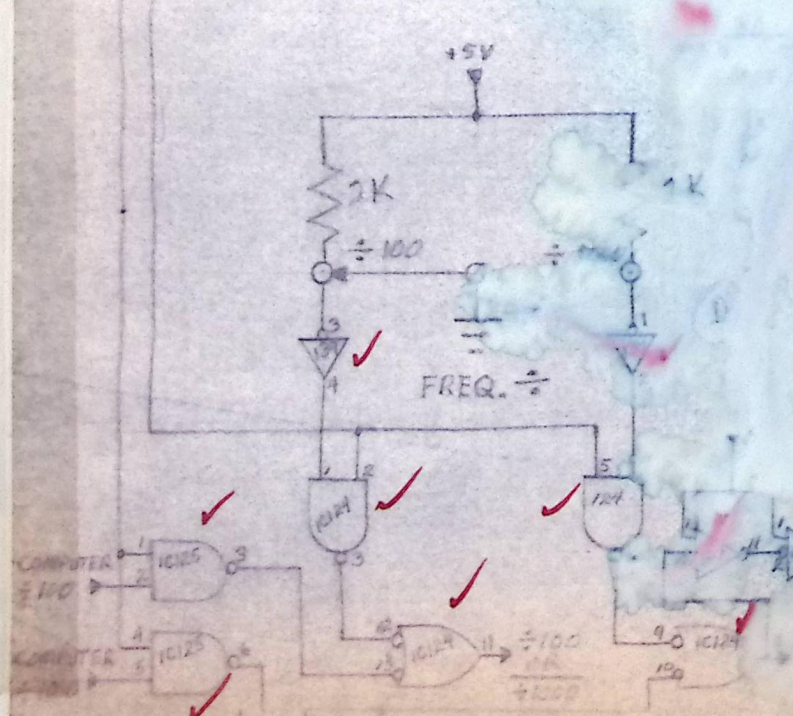
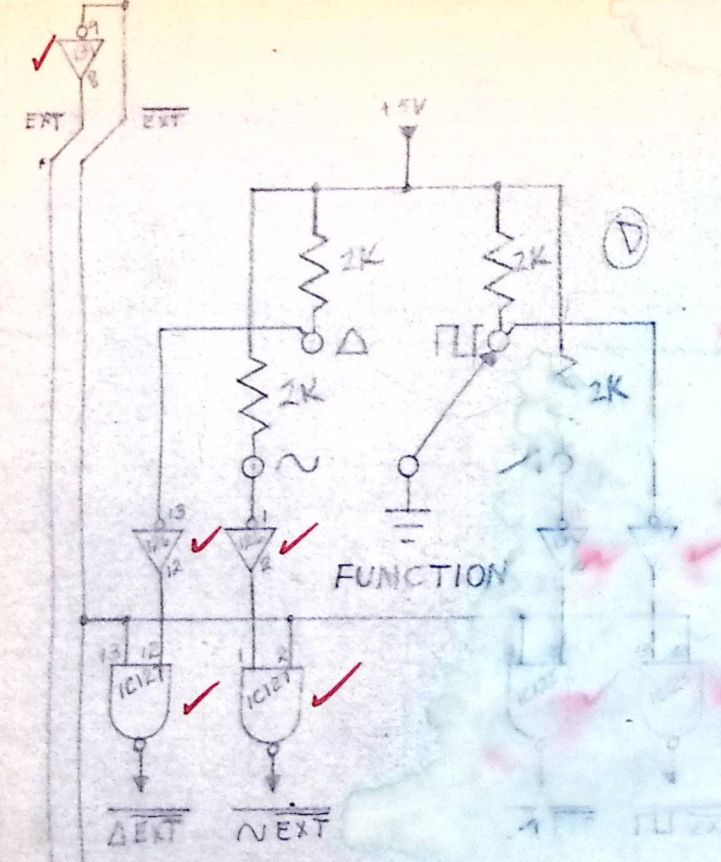
1100 SN 7482 N

NO.	TYPE
1C101	SN7483 N
1C102	SN7483 N
1C103	N7404 A
1C104	SN7482 N
1C105	SN7483 N
1C106	SN7483 N
1C107	N7400 A
1C108	SN74H20 N
1C109	SN74H20 N
1C110	SN74H20 N
1C111	PD74H00 N
1C112	SN74H26 N
1C113	N7400 A
1C114	SN74H00 N
1C115	SN7482 N
1C116	SN7483 N
1C117	SN7483 N
1C118	MC830P
1C119	MC830P
1C120	MC830P
1C121	N7404 A
1C122	N7400 A
1C123	PN7400 A
1C124	N7400 A
1C125	N7400 A

NO.	TYPE
1C126	N7404 A
1C127	N7400 A
1C128	N7400 A
1C129	N7410 A
1C130	N7410 A
1C131	SN74H10 N
1C132	SN74H00 N
1C133	N8284 A
1C134	MC830P
1C135	MC830P
1C136	MC830P
1C137	MC830P
1438	SN7420 N
1439	N7404 A
1C140	N7400 A
1C141	9601 M
1C142	N7410 A
1C143	N7410 A
1C144	SN74H30 N
1C145	SN7473 N
1C146	N8284 A
1C147(1A)	AMDAC 100
1C148(2A)	2515
1C149(3A)	2515
1C150(4A)	4094/15C
1C151(5A)	AMDAC 100
1C152(6A)	2515
1C153(7A)	2515
1C154(8A)	4094/15C



- SWITCH POSITIONS
1. EXT $\Rightarrow$ COMPUTER CONTROLLED
 2. SYNC ON MORE. RESET FROM SCANDI WHITE
 3. 11 11 SECT. CHANGE 11
 4. 11 11 INTERNALLY GEN
 5. FREE RUN
- * PHASE SET BY FRONT PANEL SW.

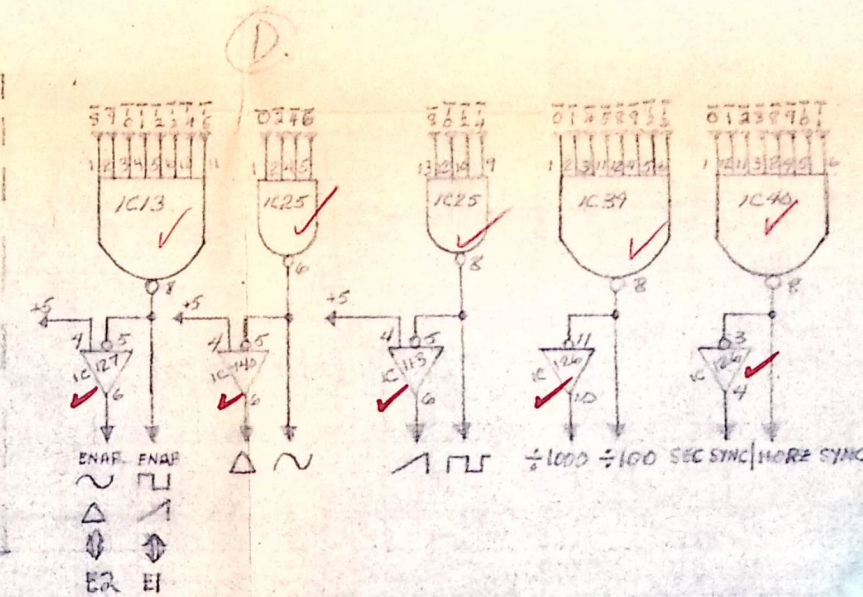
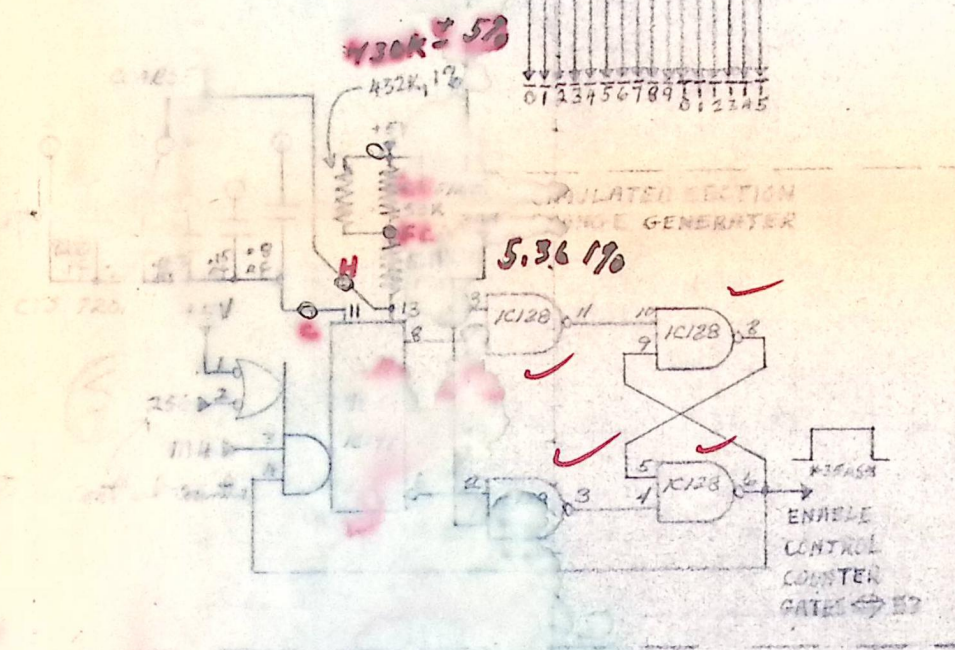


COMPUTER CONTROL

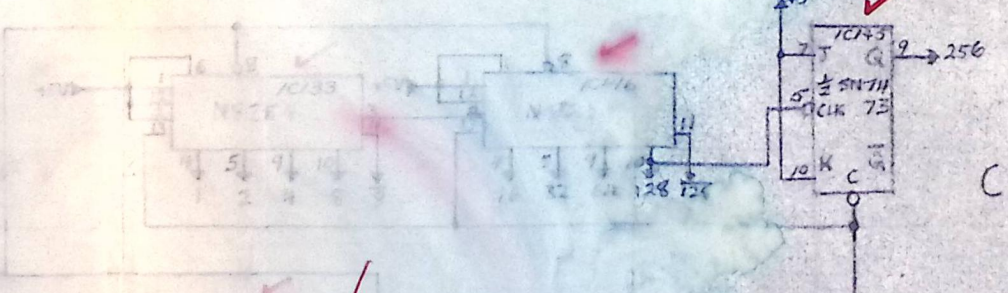
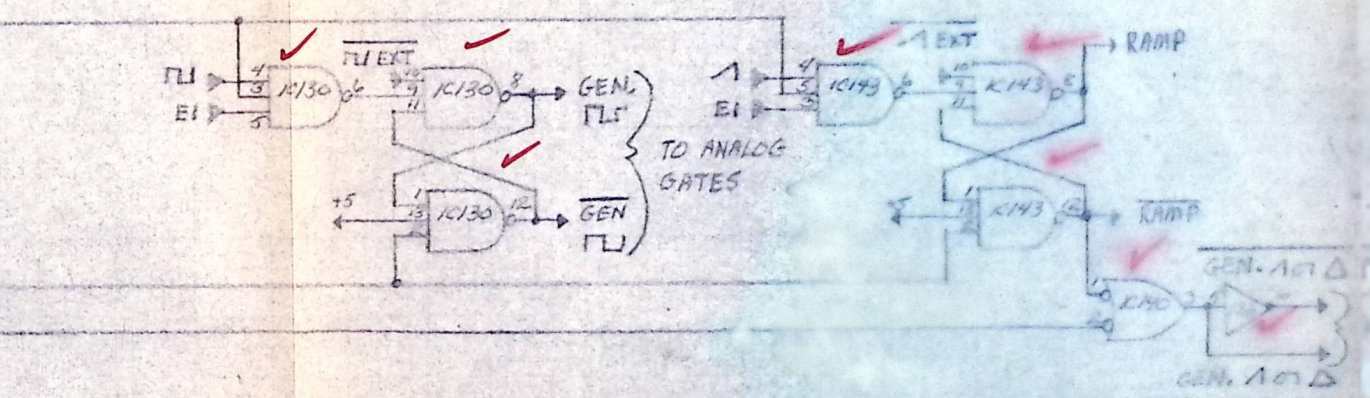
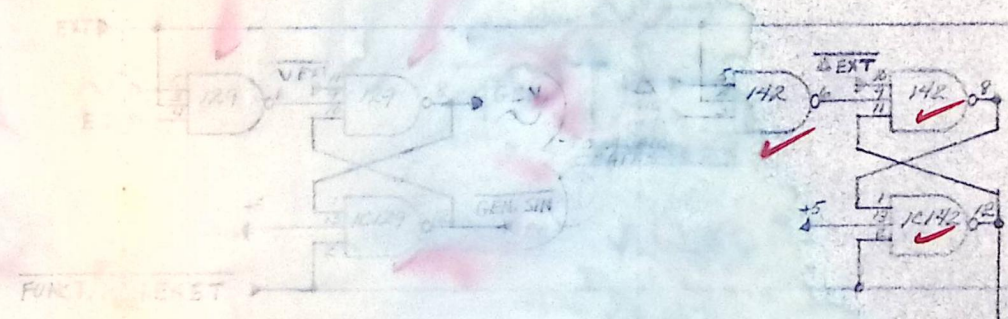
EXT NO. $\rightarrow$

BINARY NUMBER IN SYNTH	$\sim 1/0$ $\Delta = 1$	$\sim 1/1$ $\Delta = 1$	$\div 100 \div 1000$ $\div 100 = 0$ $\div 1000 = 1$	HORE SYNC SEC SYNC
0000	0		0	0
0001	1		0	0
0010	0		1	0
0011	1		1	0
0100	0		0	1
0101	1		0	1
0110	0		1	1
0111	1		1	1
1000		0	0	0
1001		1	0	0
1010		0	1	0
1011		1	1	0
1100		0	0	1
1101		1	0	1
1110		0	1	1
1111		1	1	1

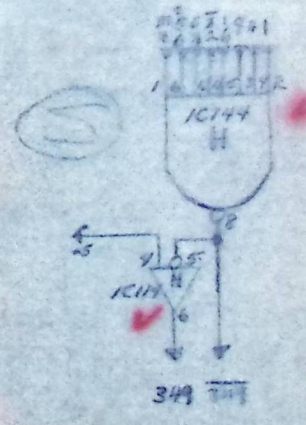
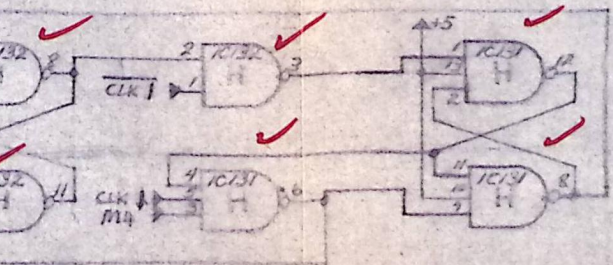
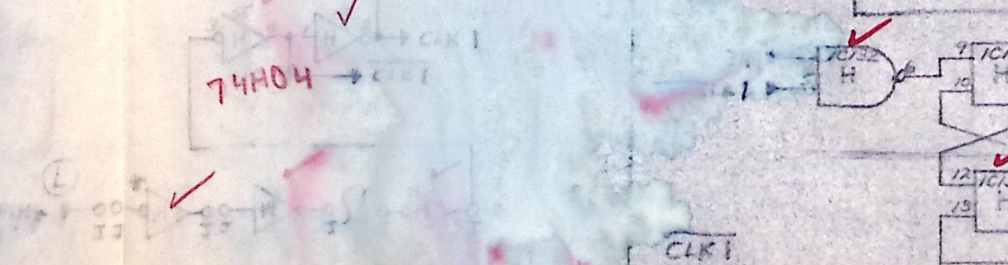
FST. LAT.



FRONT PANEL CONTROL

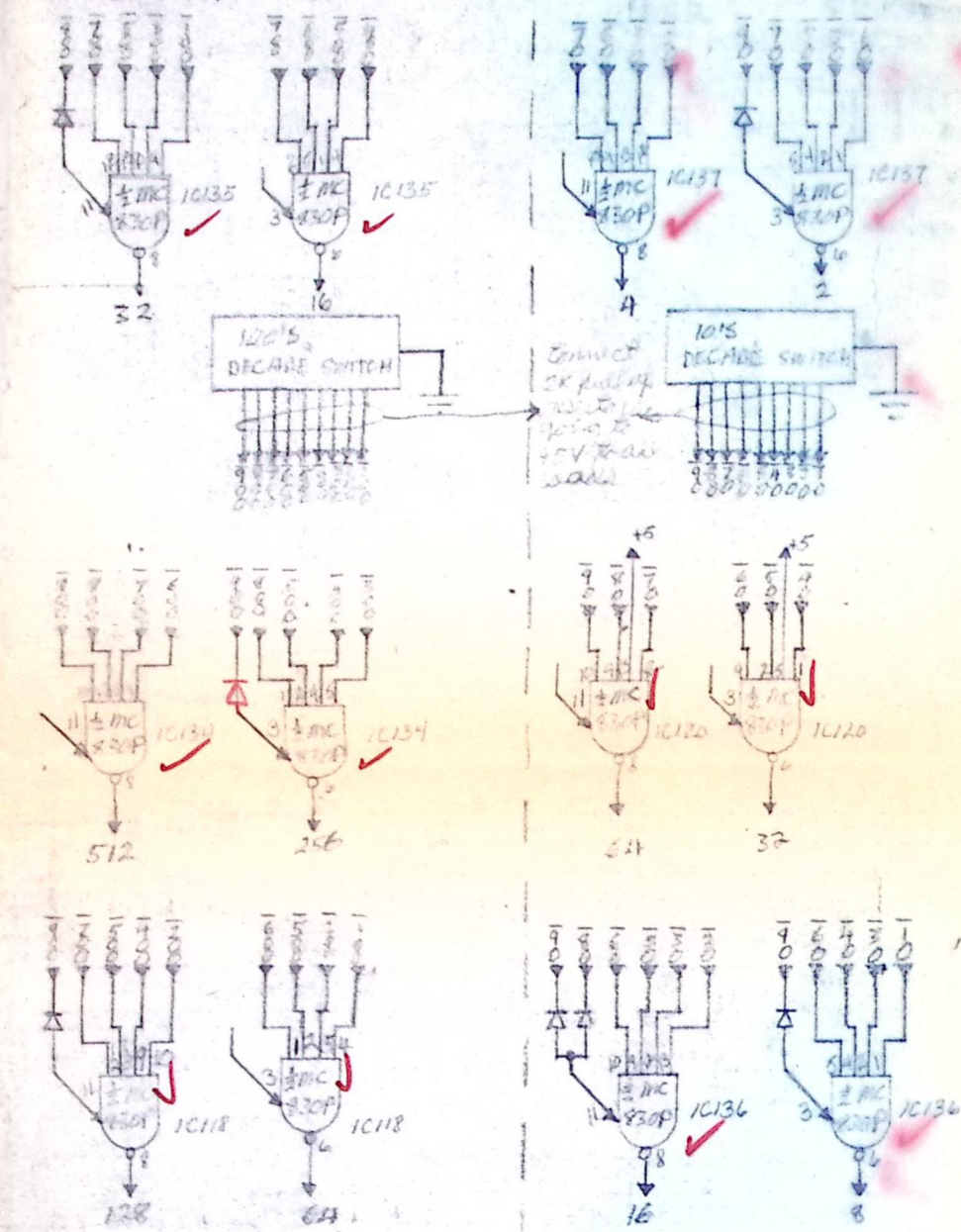


CONTROL COUNTER



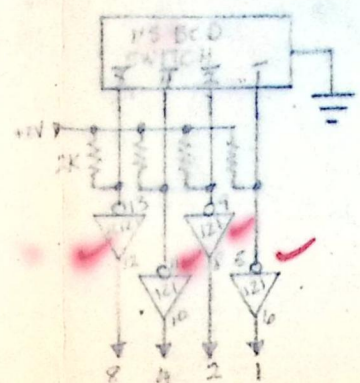
CLK2 MUST GO NEGATIVE WITHIN 45ms AFTER THE SYN. FREQ. AT THE COUNTERS GOES POSITIVE.

27-19345
WAVEFORM SYNTHESIS

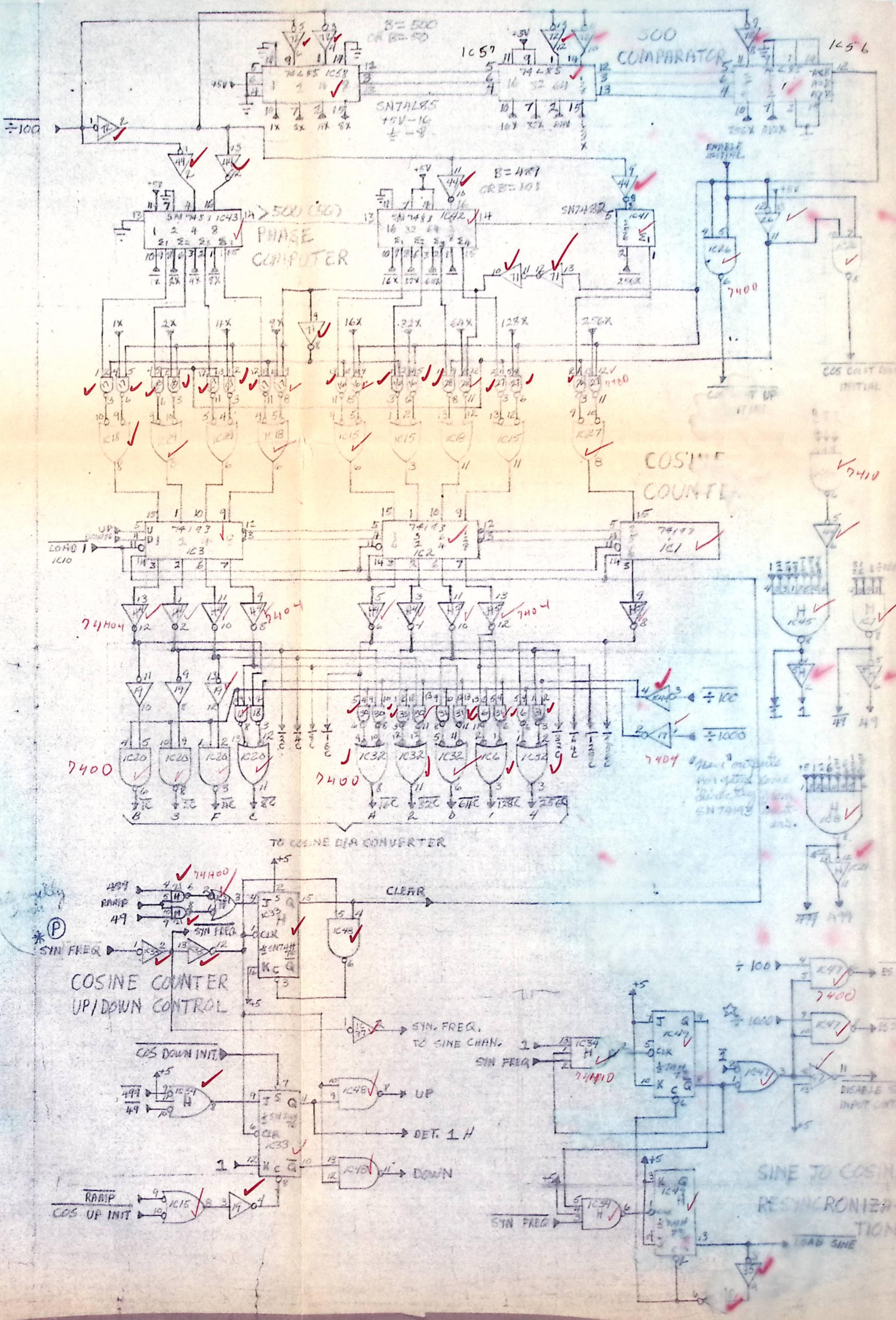
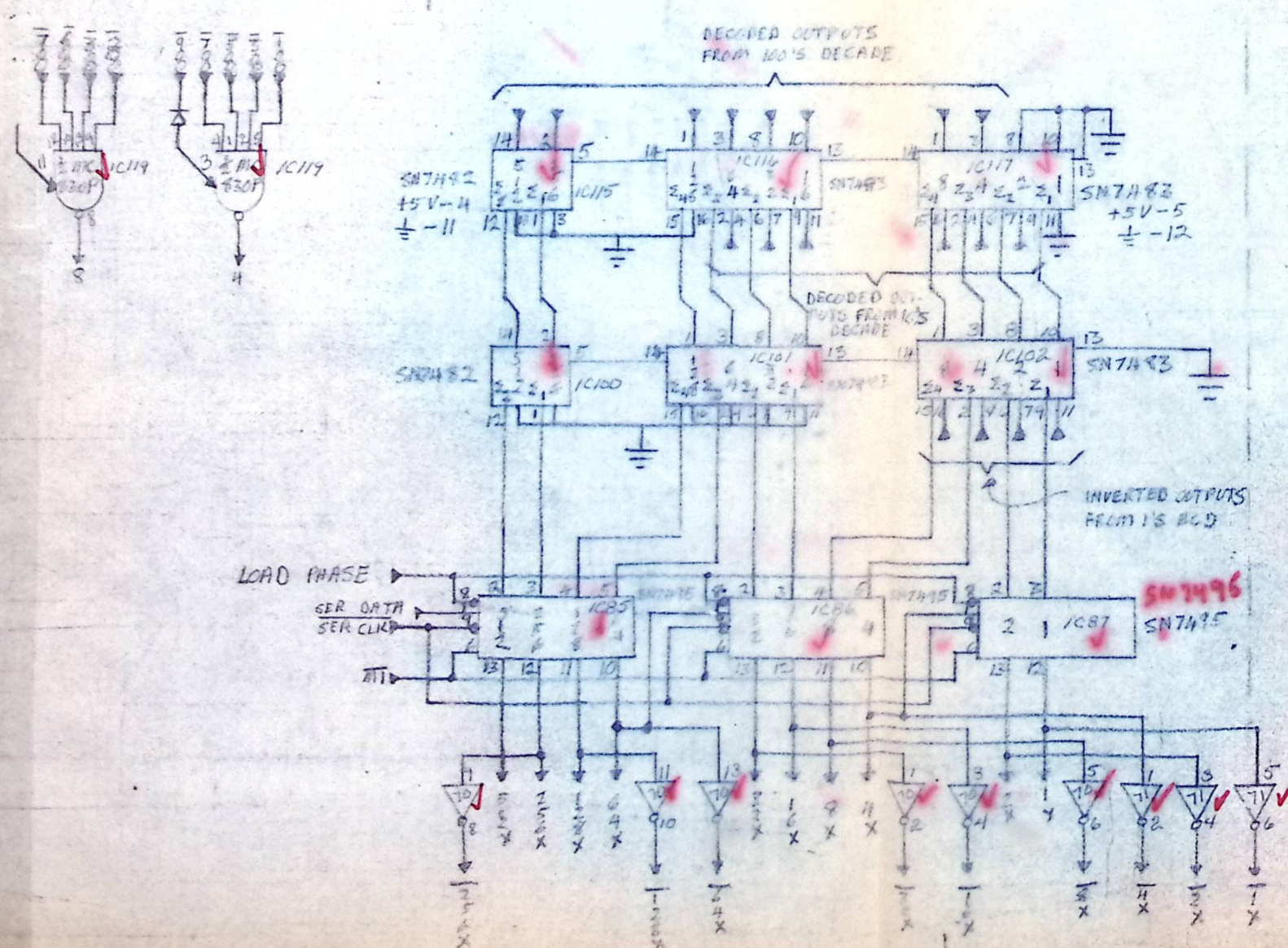


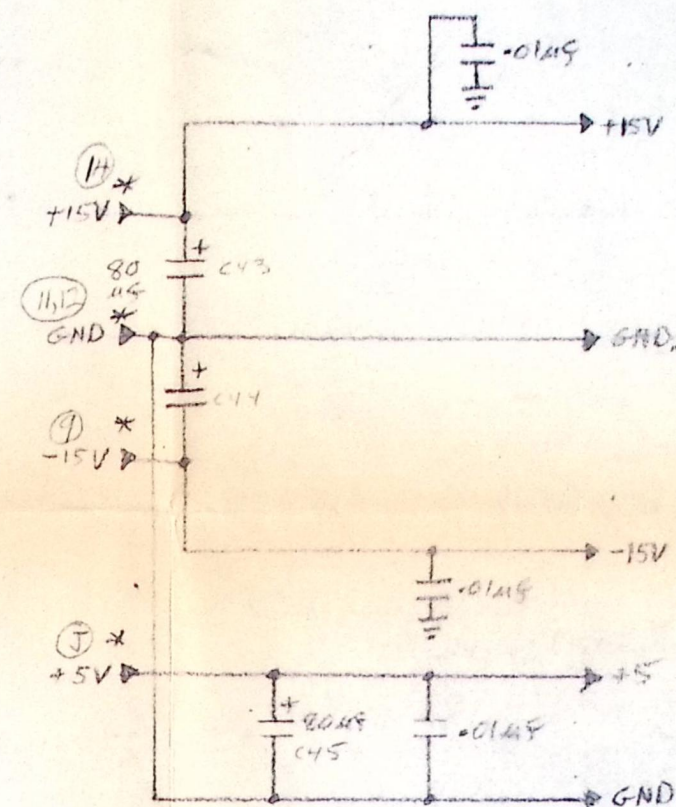
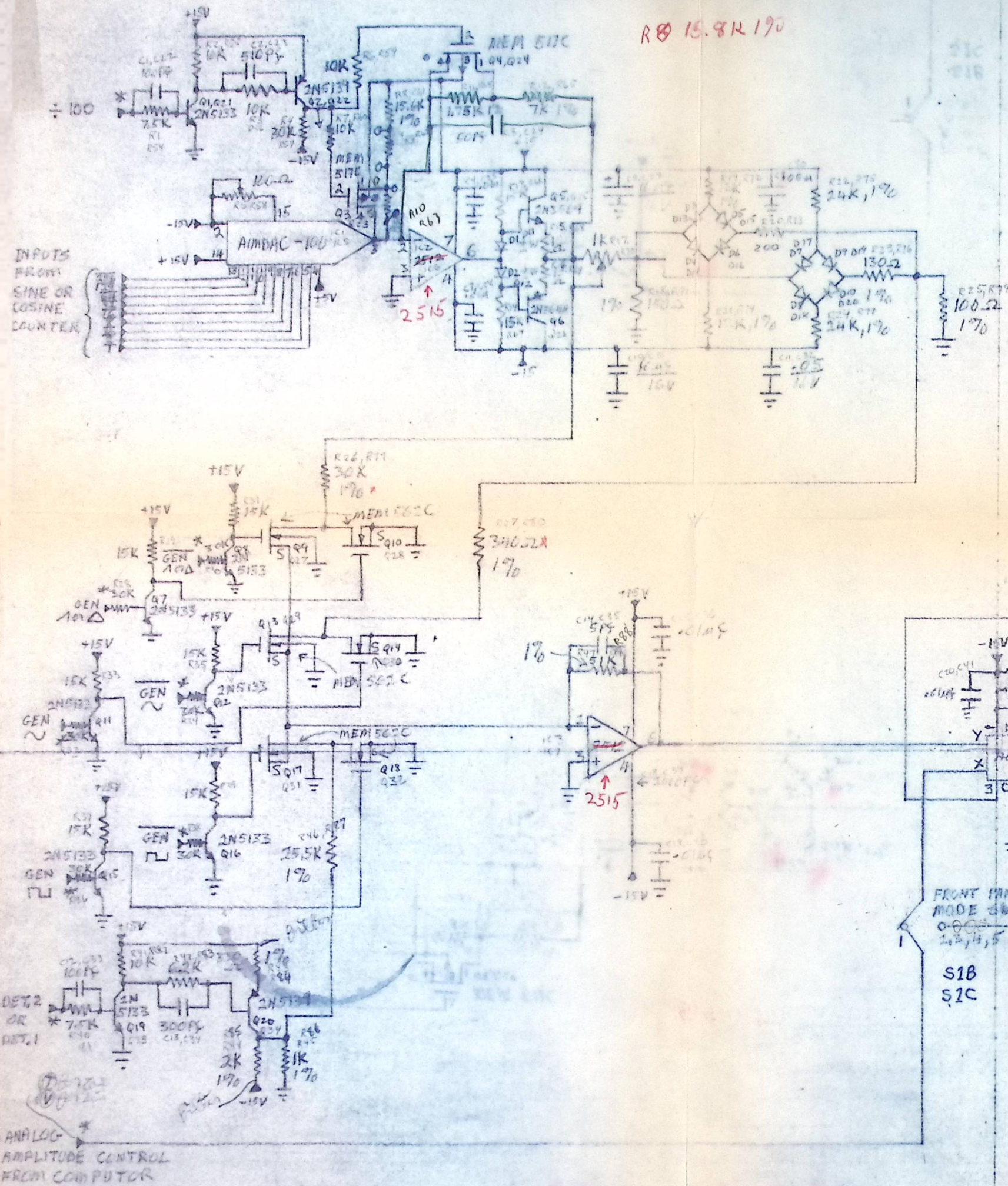
BCD TO BINARY CONVERTER

all switches 2" x 1.5"



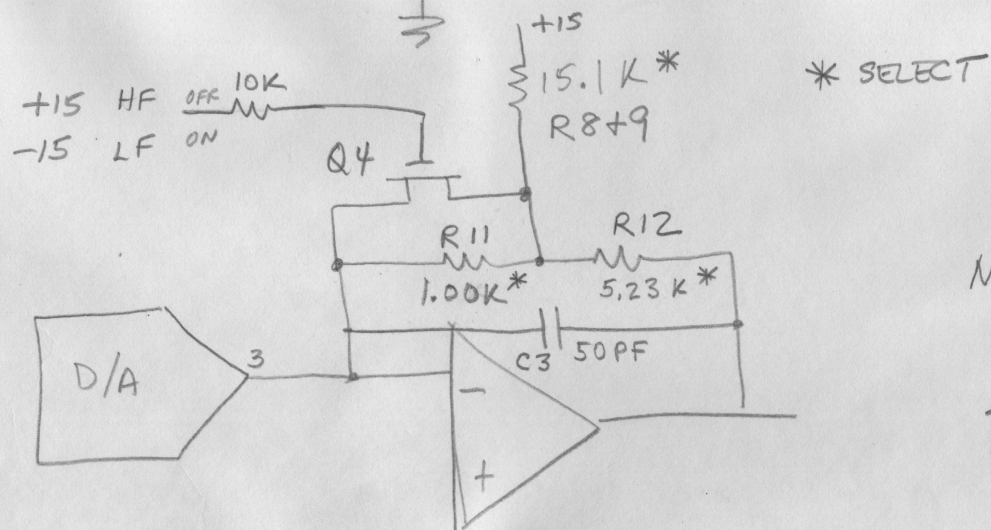
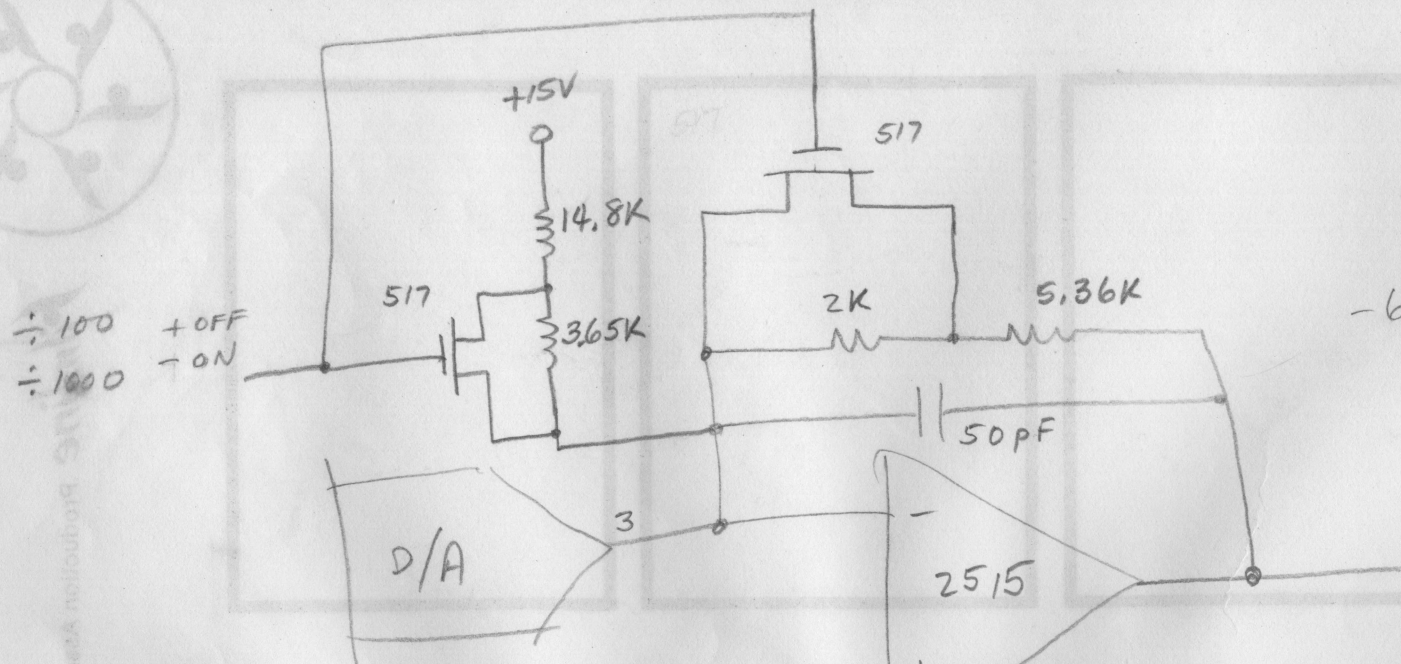
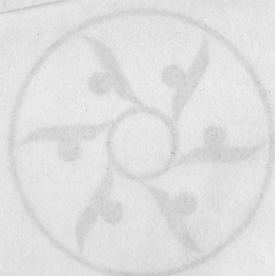
all switch outputs are wired to a common bus except when they are grounded. In this case, they are grounded.





WAVEFORM SYNTHESIZER
SHEET 4

* indicates input to or output from board.



FG-100

FG		R12 1.5K SIN	R11 1K	R8+9 15K	15.52
1	SIN	5.36	1.05	15.7	5.10
1	COS	5.23	1.00	15.1	5.23
2	SIN	4.99	.976	14.1	5.11
2	COS	5.36	1.07	15.0	5.01
3	SIN	4.99	1.00	14.7	4.99
3	COS	5.23	1.02	15.52	5.13

ENGINEERING CHANGE NOTICEDATE 8-9-82Reference Dwg No. CIC-13 ☒ Schem. ☐ Assy ☐ SystemInitiated By JGThis change will effect units (from-only) s/n Prototype +026-4 - retrofits TBDP.C. Board ☐ Schem. ☒ Wire. List ☒ 9/27/82 DMAssy ☐ M.L. ☐ Block diag. ☐P.C. Art ☐ Cable Procedure ☐

If P.C. Art is effected, change should be initiated:

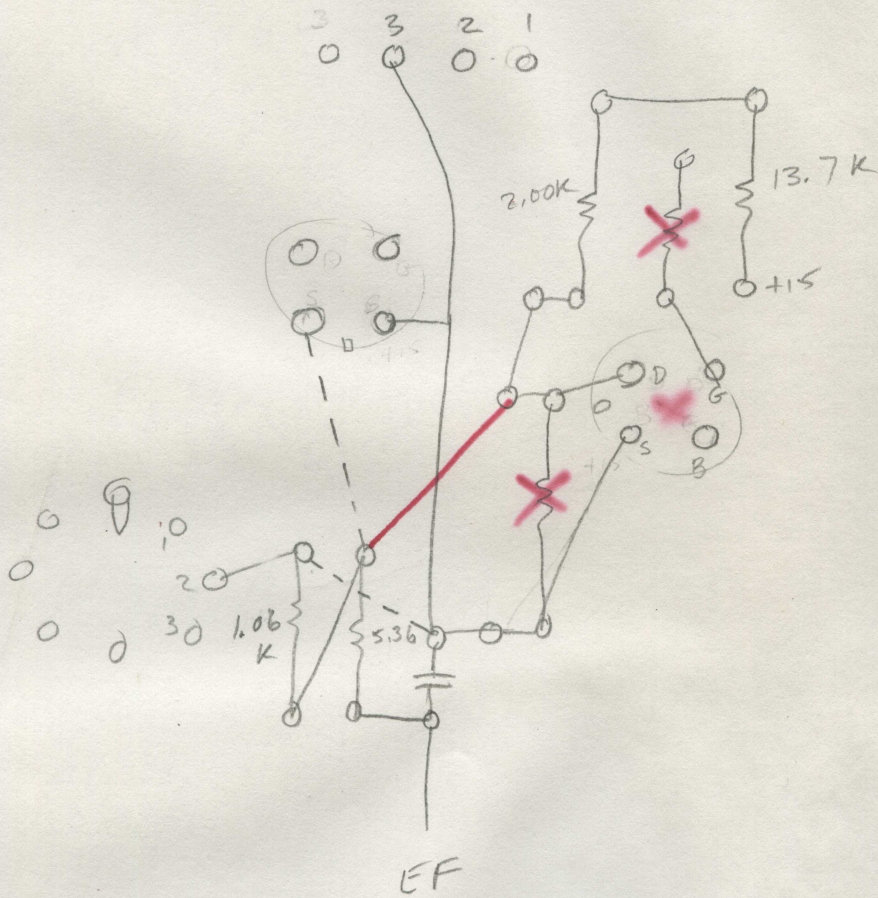
Now ☐ Later ☐ Date _____Update all work in process ☒ Test modification only ☐Change description: (Red lined drawings enclosed ☒)

Change Explanation:

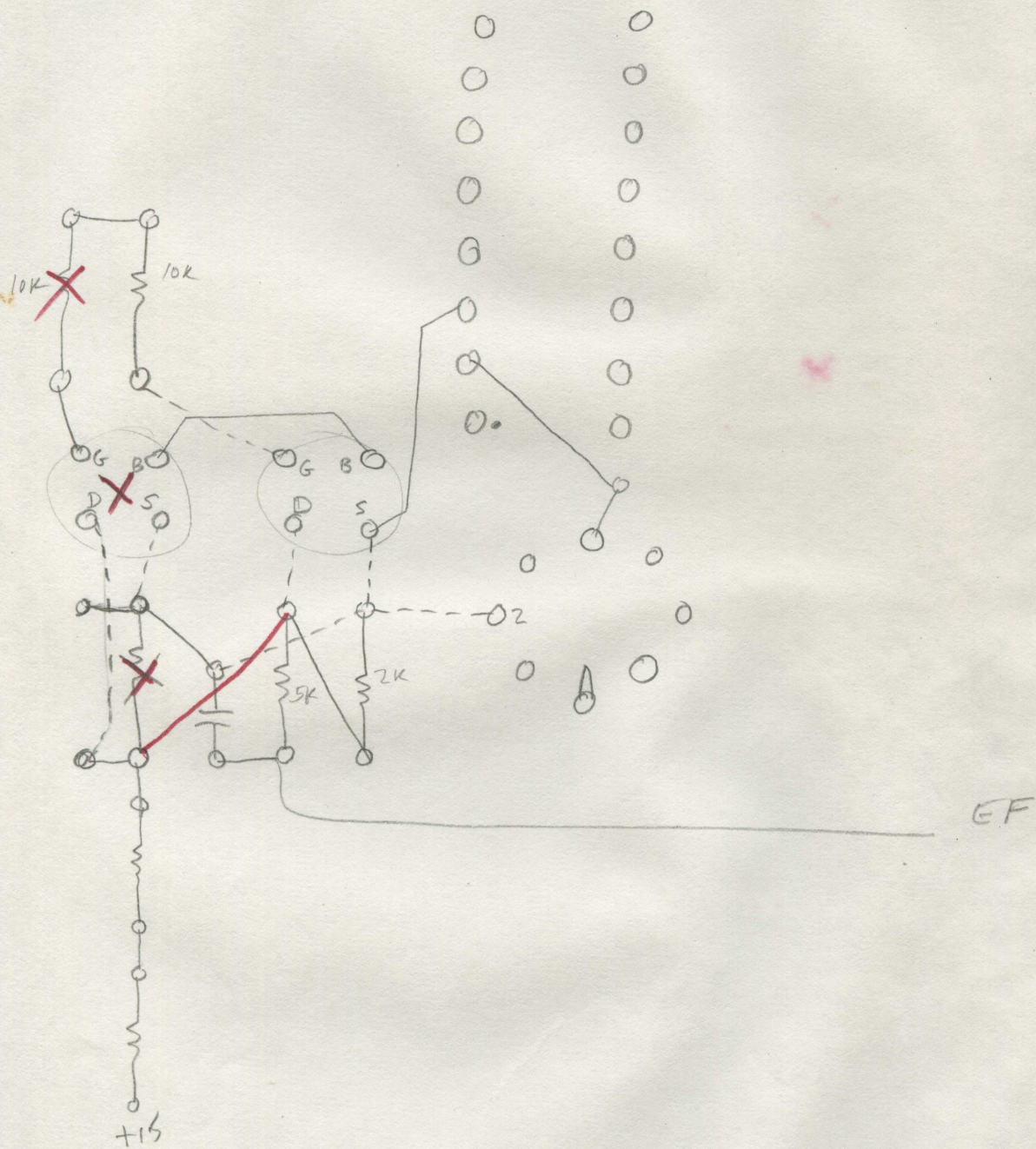
Enable computer control of audio/FG selection and intensity comp mode.

Eng. Appr. By D. J. Swirett Date 9/27/82

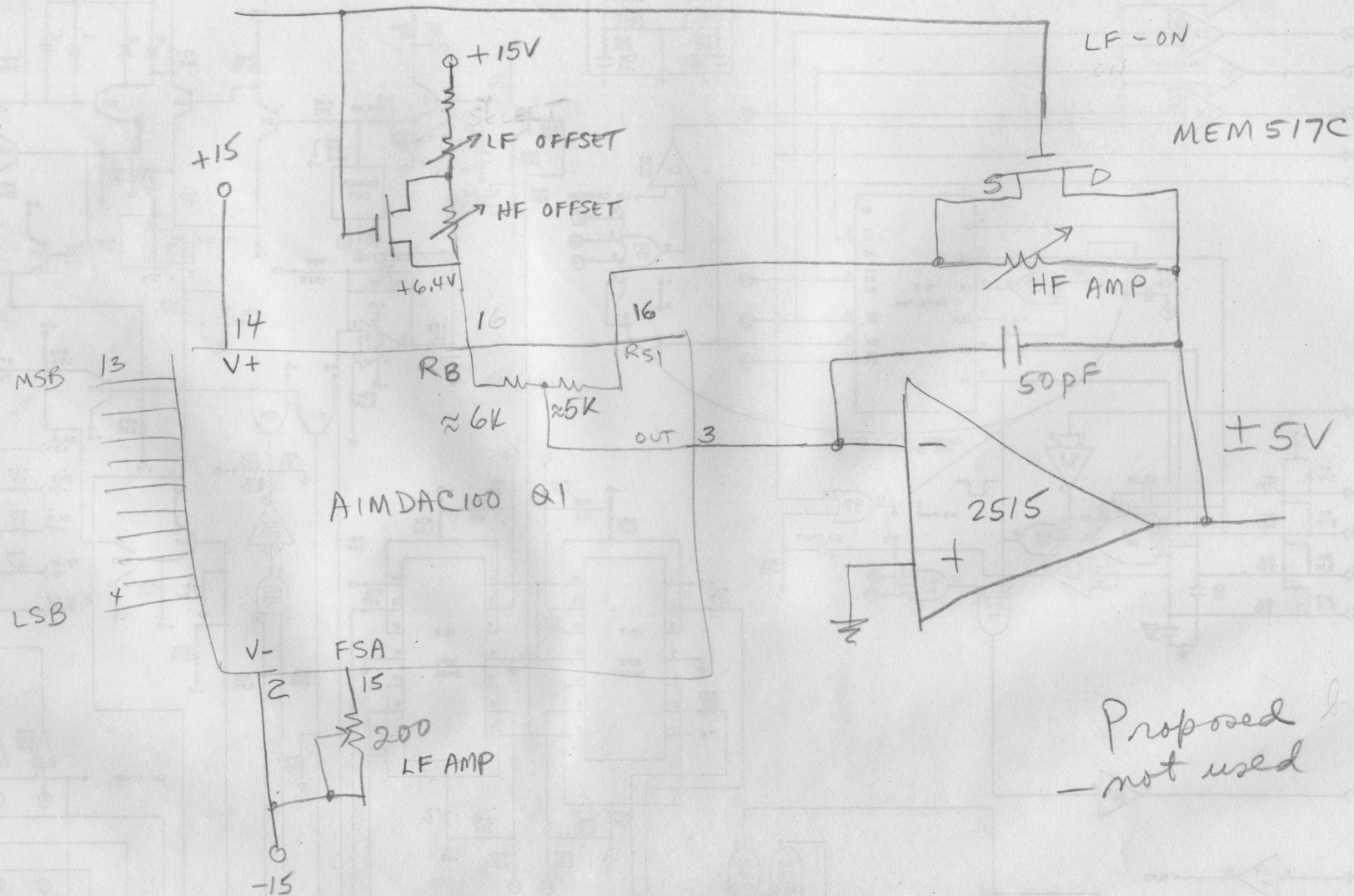
Completed By _____ Date _____



FG-100

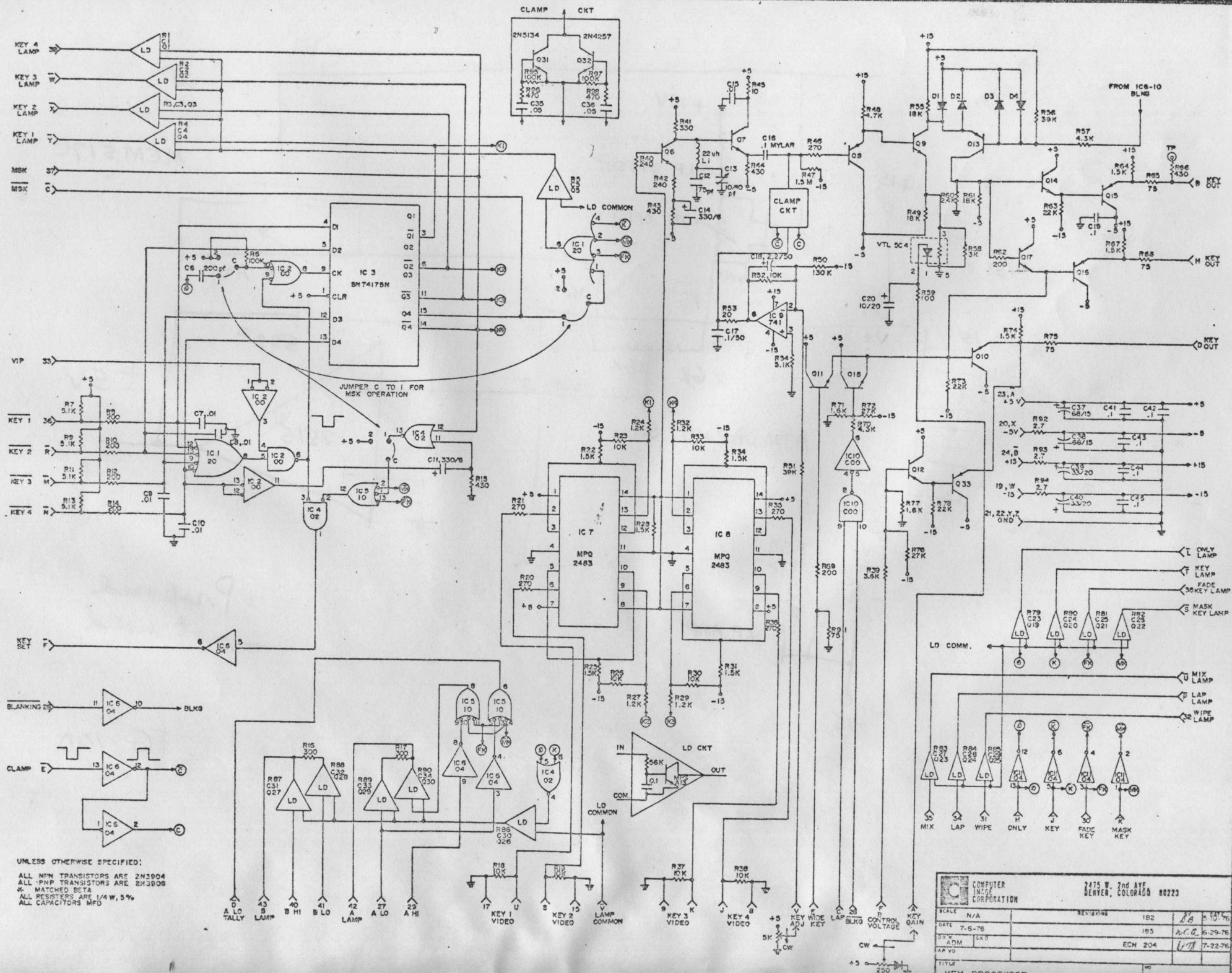


FG-100



Proposed but
- not used

FG-100

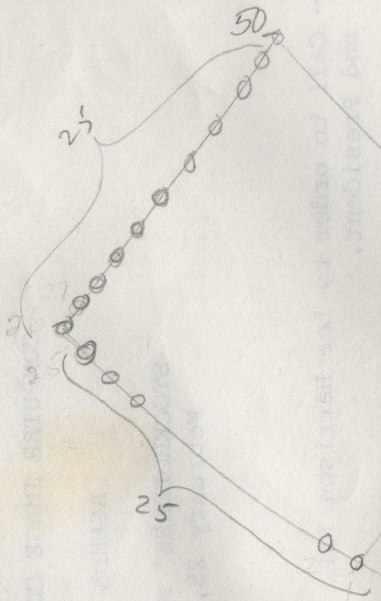


HF

62
8
496

63
8
504

LF



OLD NEW

50 → 62
49 → 61

26 → 32
25 → 31
24 → 30

1
0

1
0

LEVELS 51 63

OLD NEW

500 → 496
499 → 495

251 → 249
250 → 248
249 → 247

1
0

1
0

501 497

0
1

—

—

—

—

—

—

—

— 49

— 50

51 levels

0
25
49
50
75
100

7410

Used

Spare

7400

1C 23

ABC

A

~~127C~~

34

ABC

~~48A~~

46

ABC

~~66~~

81

ABC

88

A C

B ✓

129

ABC

130

ABC

131

ABC

ABC

142

ABC

143

ABC

7420

25

AB

138

AB

36

AB

7

B

108

AB

94

AB

109

AB

95

AB

110

A

A

1, 2, 13

12

B

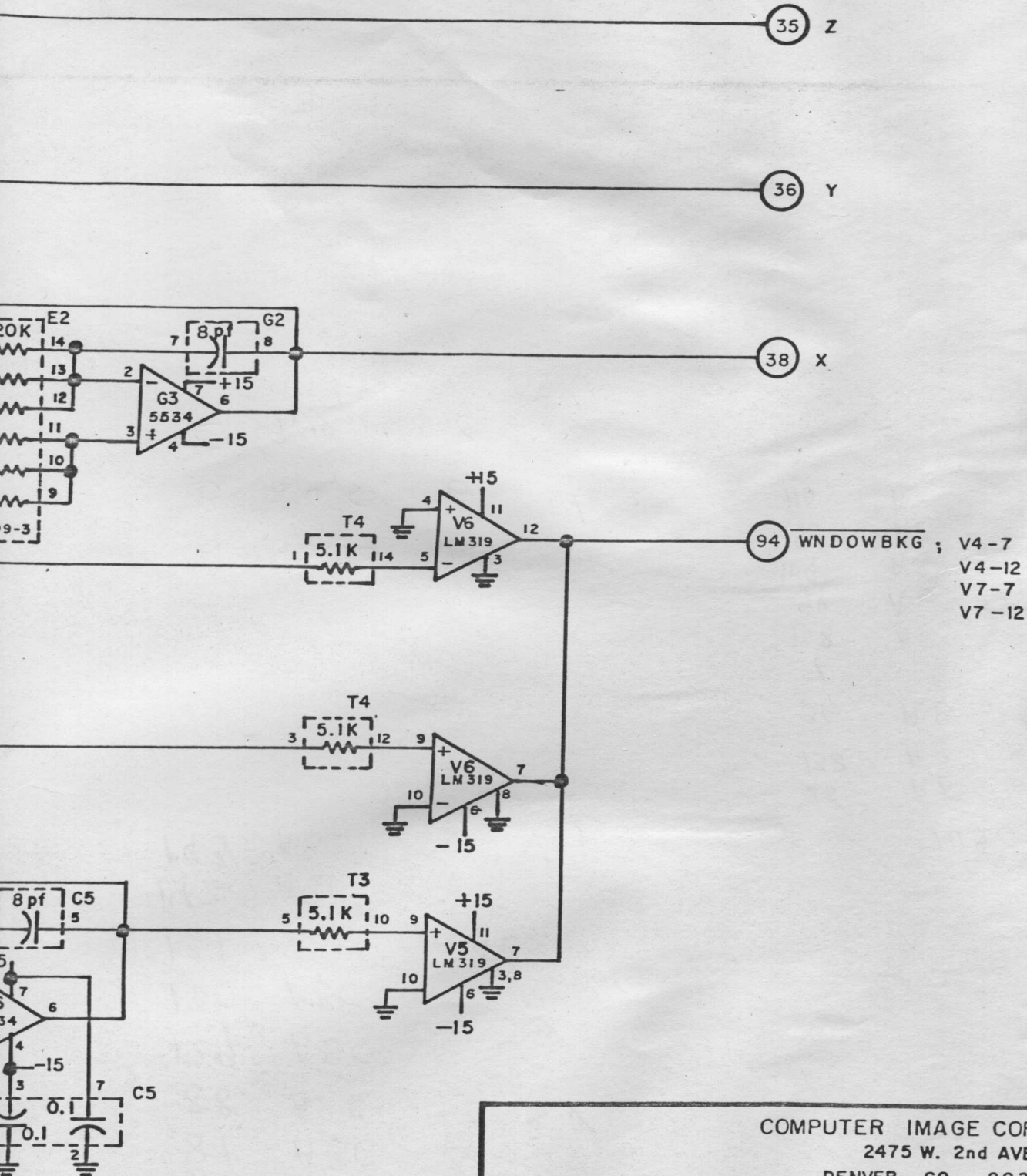
3, 4, 5

6

C

9, 10, 11

8



COMPUTER IMAGE CORPORATION			
2475 W. 2nd AVE			
DENVER, CO. 80223			
SCALE	NONE	REVISIONS	BY
DATE	10-28-81	VAN. PT.	E.R.
DRN	E.R.	CKD	
APVD			
TITLE			NO
SYSTEM IV RASTER GENERATOR			CIC-W-21
			SHEET 3 OF 4

113 7404

IC Used Spare

126 AFCEBD ✓

139 ACEDBF ✓

55 BAD CEF ✓

121 ACDEFB ✓

103 FACDEB ✓

37 CBDA X
EF ✓

70 ABCDEF ✓

71 ABCDEF ✓

72 ABCDEF ✓

44 ADEFBC ✓

5 CDEFA B ✓

19 BADEF C ✓

35 FABC DE ✓

4 ABCDEF ✓

63 CABDEF ✓

50 EFABCD ✓

92 BADEF C X

77 BACDEF ✓

82 DEABCF ✓

83 ABCFED ✓

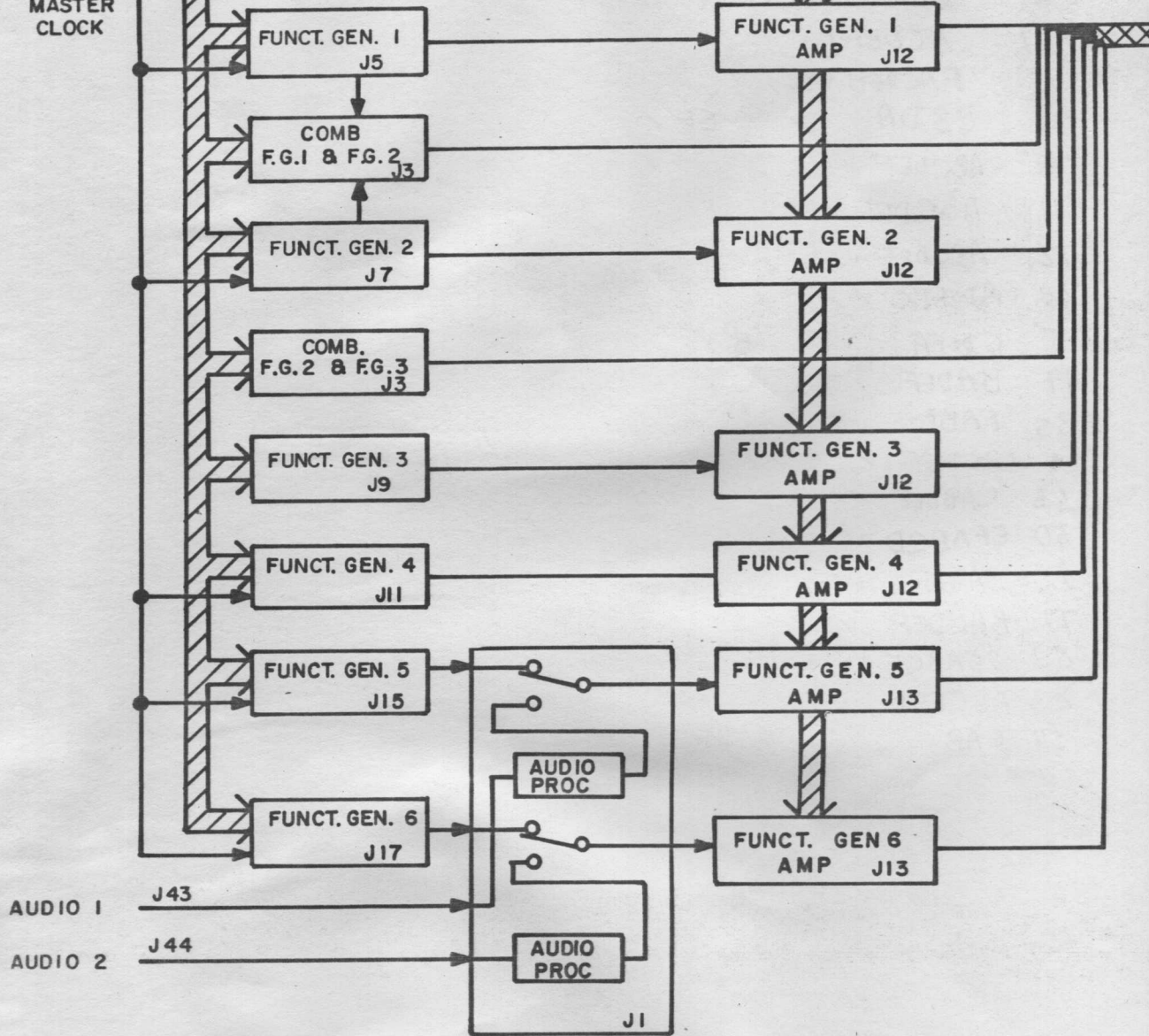
54 EAB CDF ✓

113 7404

IC	Used	Spare
126	AFCEBD ✓	
139	ACEDBF ✓	
55	BAD	CEF ✓
121	ACDEFB ✓	
103	FACDEB ✓	
37	CBDA	X EF ✓
70	ABCDEF ✓	
71	ABCDEF ✓	
72	ABCDEF ✓	
44	ADEFBC ✓	
5	CDEFA	B ✓
19	BADEF	C ✓
35	FABC	DE ✓
4	ABCDEF ✓	
63	CABDEF ✓	
50	EFABCD ✓	
92	BADEFC ✓	
77	BACDEF ✓	
82	DEABCF ✓	
83	ABCFED ✓	
54	EAB	CDF ✓

MASTER CLOCK J40
SYSTEM IV
DIGITAL BUS

BUFFERED
MASTER
CLOCK



7400 USED

X	9	B, A, D, C	X	73	BACD
X	111	D, BAC	X	59	ADBC
X	114	BADC	X	69	BCDA
X	140	C, D, B A	X	68	DBAC
X	127	A, D, B, C	X	52	DCBA
X	113	BDCA	X	67	BACD
X	125	C, D, A, B	X	53	CBDA
X	124	ABCD	X	51	DCBA
X	107	A DCB			
X	10	DABC			
X	15	ABDC			
X	18	BCDA			
X	26	ABCD			
X	48	CDBA			
X	21	ABCD			
	46	BAC			
X	30	C B D A			
X	31	DCBA			
X	6	DBAC			
X	20	BCAD			
X	32	CDBA			
X	47	ABCD			
X	80	BCAD			
X	123	BADC			
X	78	ADBC			
X	79	DBCA			
X	122	DACB			
X	93	ABDC			

OLD

HF ($\div 100$)

100 FS steps / cycle

$$f_{\max} = 92 \text{ KHz}$$

NEW

124 FS steps / cycle

$$f_{\max} = 74 \text{ KHz}$$

LF ($\div 10,000$)

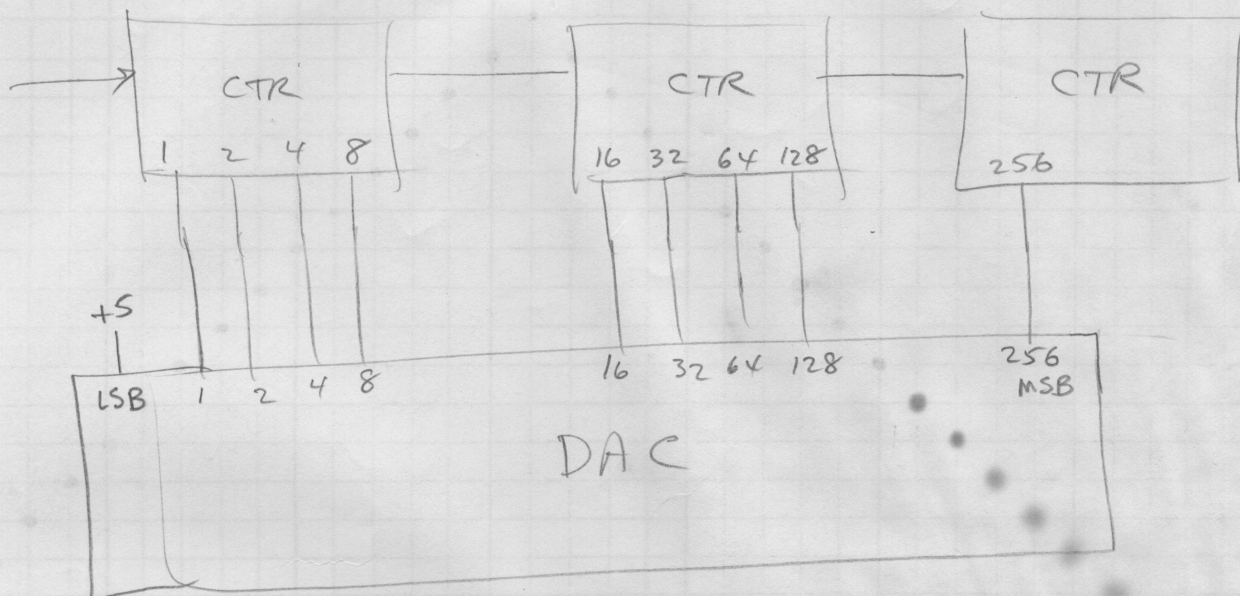
75 $\div 1000$ ($\frac{FS}{10}$) steps / cycle

$$f_{\max} = 920 \text{ Hz}$$

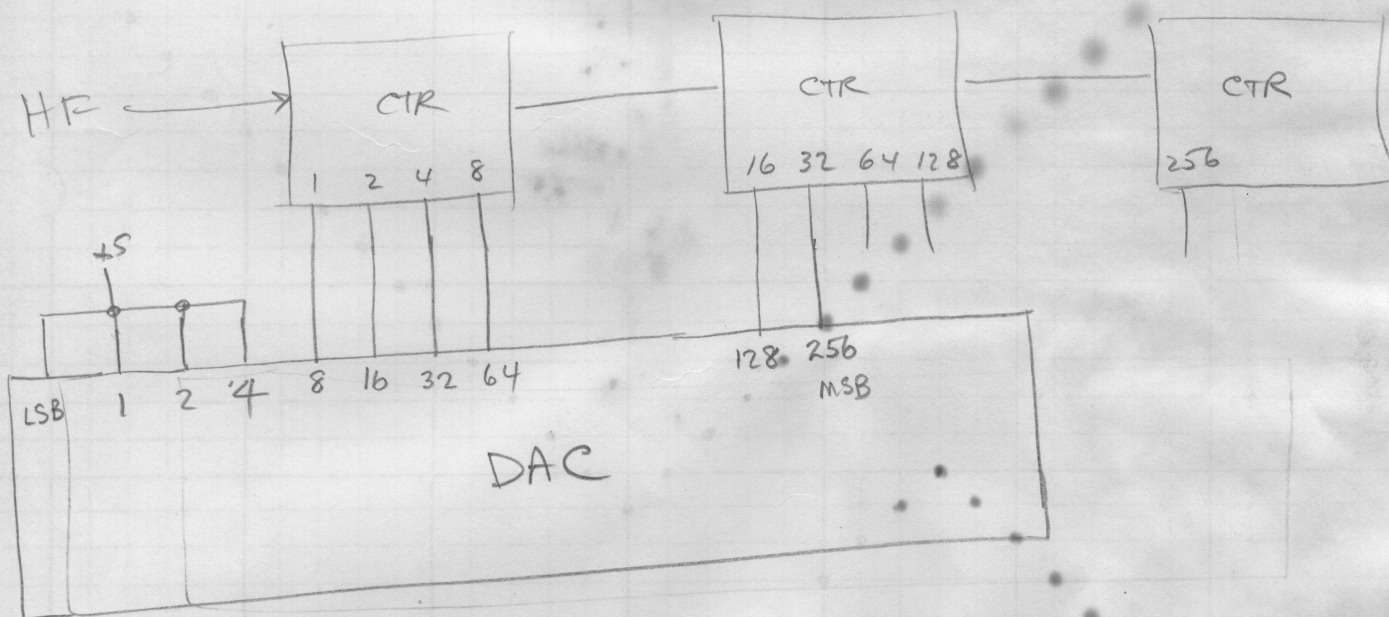
1992 $\frac{FS}{10}$ steps / cycle

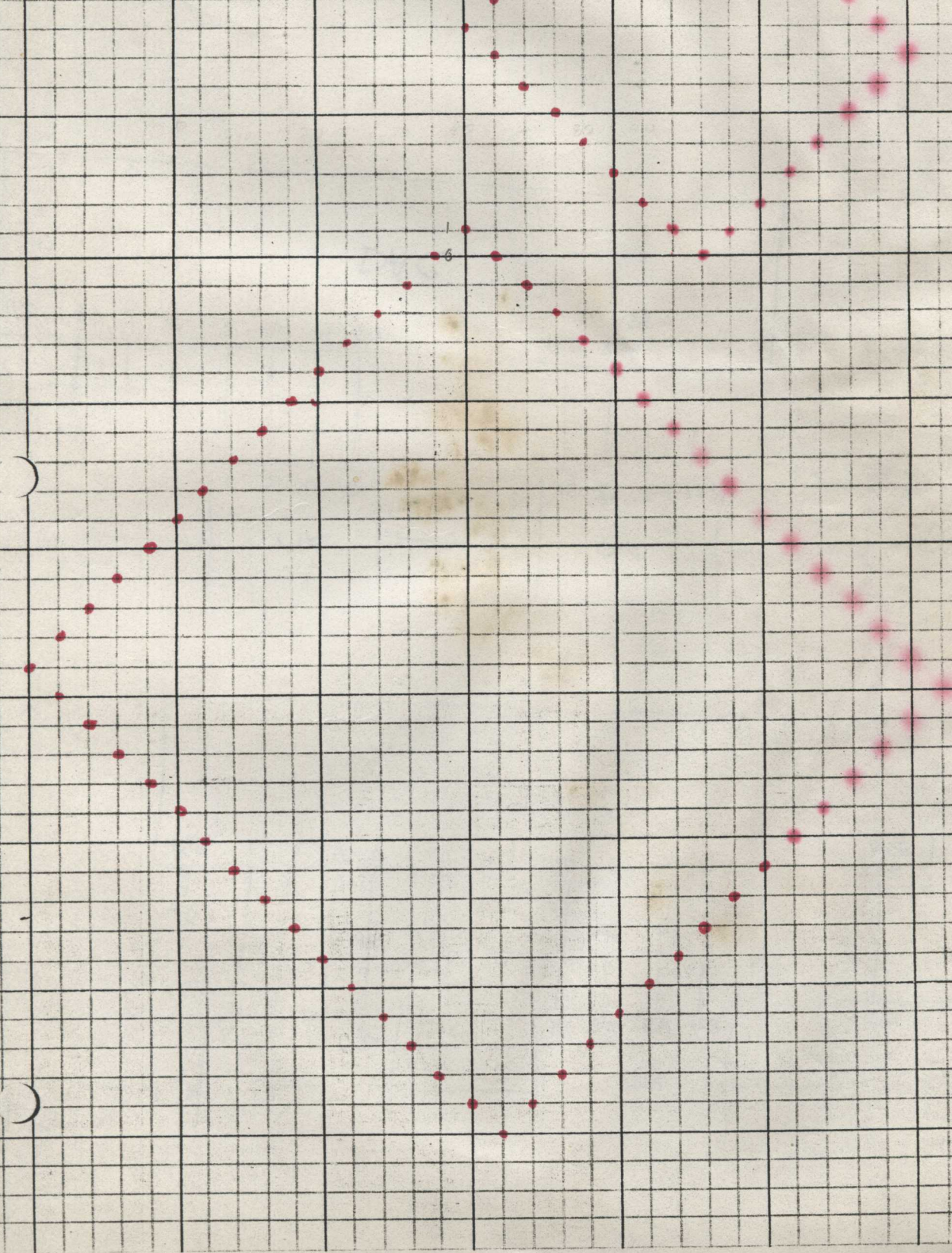
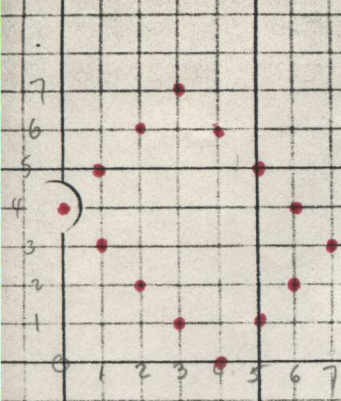
$$f_{\max} = 927 \text{ Hz}$$

LF



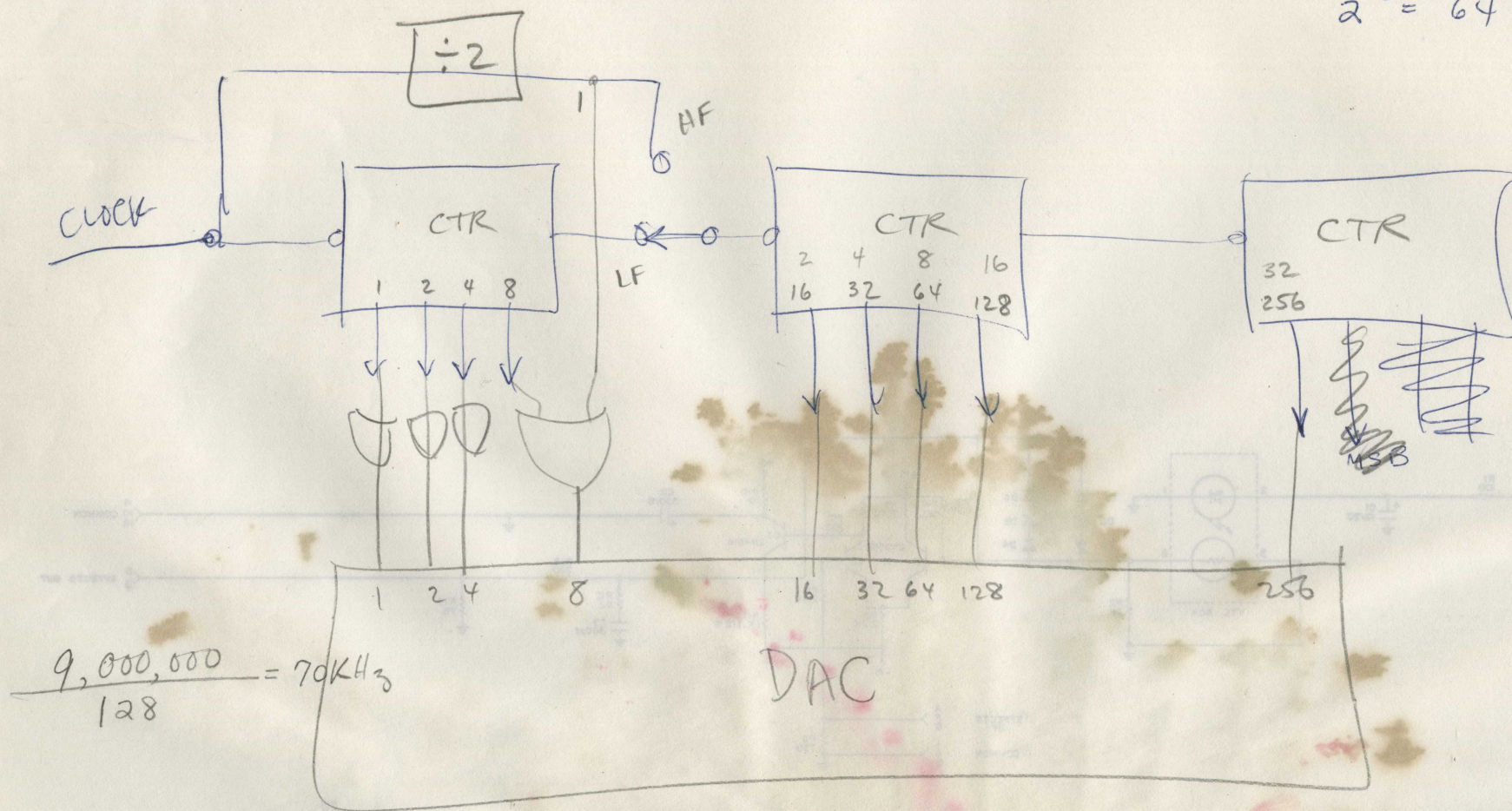
HF





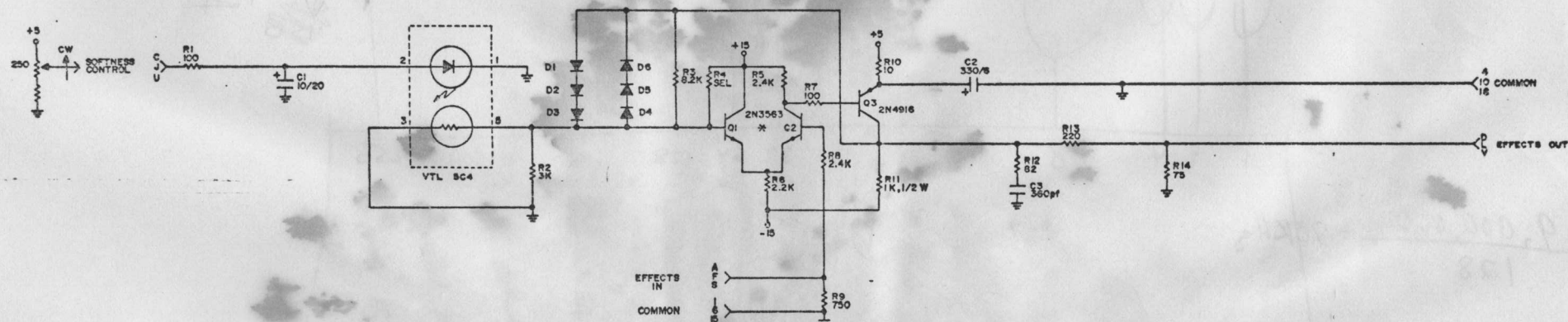
$$2^9 = 512$$

$$2^6 = 64$$

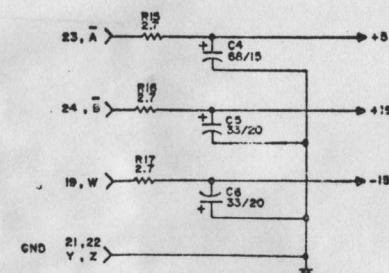


$$\frac{9,000,000}{128} = 70\text{KHz}$$

61	495
32	256
16	128
8	64
4	32
1	8
	4
	2
	1



NOTE:
 TYPICAL CKT FOR 1 VARIABLE GAIN AMP SHOWN
 INPUT & OUTPUT PINS FOR 2 ADDITIONAL CKTS. AS
 REQUIRED IN -2 & -3 VERSION ARE ALSO SHOWN.
 ALL DIODES ARE IN3084
 * MATCHED BETA (Q1+Q2)



COMPUTER IMAGE CORPORATION 2475 W. 2nd AVE DENVER, COLORADO 80223	
SCALE	N/A
DATE	8-1-76
DRN	ADM
REV	1
TITLE	VARIABLE GAIN AMPLIFIER
NO	VS-135-1,2,3

TOLERANCE	
FRACT.	± 1/22
.XX	± .015
.XXX	± .005

63

32

31

32

0

31

63